# ATER and RELATED LAND RESOURCES
# HUMBOLDT RIVER BASIN
## NEVADA

REPORT NUMBER SIX

# MAGGIE CREEK SUB-BASIN

OCTOBER, 1963

Based on a Cooperative Survey

*by*

THE NEVADA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

*and* THE UNITED STATES DEPARTMENT OF AGRICULTURE

Prepared by

Economic Research Service - Forest Service - Soil Conservation Service

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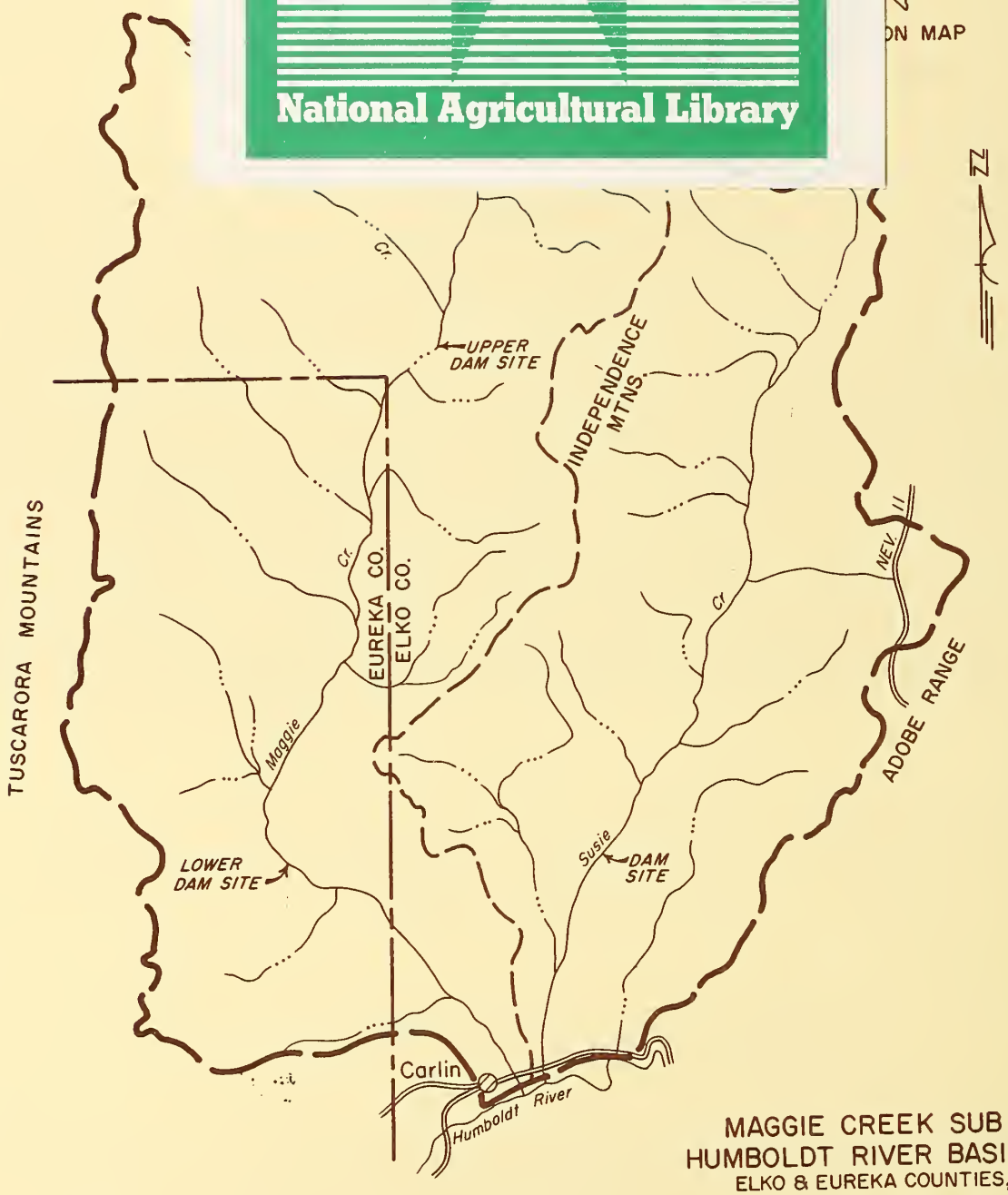
ELKO CO.
Maggie Creek
Sub-Basin
EUREKA CO.

ON MAP




MAGGIE CREEK SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
ELKO & EUREKA COUNTIES, NEVADA
AUGUST 1963

1 0 1 2 3 4
SCALE IN MILES

COVER PHOTOGRAPH - *Haying operations on Maggie Creek north of Carlin, Nevada, looking southeast toward the Humboldt Valley.*

S.C.S. PHOTO--6-782-7

REGISTER

REPORT NUMBER SIX
MAGGIE CREEK SUB-BASIN
OCTOBER 1963

Will you please detach and fill out this form; mail it to us, so that we may send you any additions, changes, or corrections.

Humboldt River Basin Field Party
P.O. Box 982
Elko, Nevada 89801

Name _____

Address _____

_____

_____

# WATER AND RELATED LAND RESOURCES

# REPORT NUMBER SIX

# HUMBOLDT RIVER BASIN

# NEVADA

## MAGGIE CREEK SUB-BASIN

Based on a Cooperative Survey
by
The Nevada Department of Conservation and Natural Resources
and
The United States Department of Agriculture

Forest Service - Soil Conservation Service
Economic Research Service

October 1963

# FOREWORD

This is a report for the people of Nevada, and particularly for the people of the Humboldt River Basin, concerning water and related land resources in the Maggie Creek Sub-Basin. It is the sixth of a series of reports which will result from a cooperative survey of the Humboldt River Basin by the Nevada State Department of Conservation and Natural Resources and the U. S. Department of Agriculture. It was prepared by the Soil Conservation Service and the Forest Service of the Department of Agriculture.

The State of Nevada seeks constantly to assist local people and their organizations in the conservation, development and management of water resources. It has particular regard for the relationship of water to land and to human resources. This is exemplified by the creation of the Nevada State Department of Conservation and Natural Resources. A primary responsibility of that Department is to cooperate with Federal agencies and local groups and to coordinate State-Federal activities that help solve water and related land problems for the people of Nevada.

The responsibilities of the Nevada State Department of Conservation and Natural Resources, and the cooperative research work already under way in the Humboldt River, set the stage for Federal-State cooperation in developing information on opportunities for improving the use of the land and water resources of the Basin. Accordingly, cooperation was initiated with the U. S. Department of Agriculture under a Plan of Work dated June 3, 1960 with agencies of the Department and of the State of Nevada participating in the survey. It is important here to point out that responsibility for matters concerning State water rights and determination of water supply as it might affect State water rights was assumed by the State of Nevada.

This cooperative survey of the Humboldt River Basin is for the primary purpose of determining where improvements in the use of water and related land resources, some of which have social and economic aspects, might be made with the assistance of projects and programs of the U. S. Department of Agriculture. A major part of the survey is focused on situations where improvement might be brought about by means of Federal-State-local cooperative projects developed under the Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress as amended). This survey is in keeping with long established tradition in the Department of Agriculture of cooperation with States and local entities in the conduct of its work. Further, such cooperation is a most important responsibility of the Nevada State Department of Conservation and Natural Resources.

The U. S. Department of Agriculture-State of Nevada Plan of Work in the Humboldt River Basin offers opportunities for participating in the survey by other Nevada State agencies and Federal agencies. The Bureau of Land Management, as an example, has cooperated with respect to the national land reserve. Thus, the survey is not limited but is rather as broad in scope and agency participation as is required to meet the agreed upon objectives.

The entire Humboldt River Basin is being studied by segments identified as sub-basins. This report contains much information for study and use in understanding and

solving some of the existing water and land resource problems in the Maggie Creek Sub-Basin. The report presents opportunities for Federal-State-local project-type developments under the Watershed Protection and Flood Prevention Act, together with other opportunities for development and adjustment.

I wish to recognize the excellent work of the U. S. Department of Agriculture and the State Department of Conservation and Natural Resources in this cooperative effort. I consider that this report will serve the best interest of the people in the Humboldt River Basin and the State of Nevada.

Grant Sawyer

Governor of Nevada

# HUMBOLDT RIVER BASIN SURVEY

## MAGGIE CREEK SUB-BASIN REPORT

## CONTENTS

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## ORGANIZATION OF REPORT

The report on the Maggie Creek Sub-Basin is divided into three main sections. The first section is an overall report on the sub-basin; the remaining two sections consist of Appendix I and Appendix II, respectively.

Appendix I is attached to all the report copies, and contains pertinent textual material concerning the sub-basin which is of value to the general reader.

Appendix II is produced in a relatively limited number of copies. Its small appeal to the general reader renders it unsuitable for inclusion with the report copies for general distribution. However, this type of material does have potential value as an information reservoir for technicians, administrators, and resource managers concerned with the Maggie Creek Sub-Basin. Copies of this appendix are available upon request.

# SUMMARY

The land and water resources of the lower portions of the Maggie Creek Sub-Basin were regularly exploited by the white man during the fur trade and westward emigration periods along the Humboldt main stem. These two consecutive periods stretched from Peter Skene Ogden's journey up the Humboldt in December 1828 until the advent of the Central Pacific Railroad in December 1868. The town of Carlin was established as a division point on the railroad at that time, and by 1872 had become the terminus of stage and freighting roads to the mining camps at Tuscarora, Cornucopia, and Bull Run, as well as to the Eureka and White Pine mines. Agricultural use of the sub-basin's lower reaches started in July 1868, with the raising of small grains. By 1875 livestock raising had become the sub-basin's major enterprise.

The maple-leaf shaped sub-basin extends north from the Humboldt's main stem at Carlin. Most of its area lies in Elko County, with a relatively small portion in Eureka County. The principal drainages are Maggie and Susie Creeks and their tributaries. These streams emanate from the southern portions of the Independence Range and the Tuscarora Mountains, with some Susie Creek tributaries rising in the Adobe Range.

Big sagebrush-grass or low sage-grass constitutes the predominant cover over much of the sub-basin, giving way to mixed browse-grass in the higher reaches of the Independence Range and the Tuscarora Mountains. Small amounts of aspen are found in the high basins and along a few of the higher stream courses. A few clumps of limber pine are found along the Lone Mountain crest in the Independence Range, and scattered areas of Utah juniper occur along the breaks of the Adobe Range, and on lower Maggie and Susie Creeks. Phreatophytic rabbitbrush, greasewood, willows, and saltgrass, interlaced or intermingled with scattered hay meadows, occupy the bottomlands of Maggie and Susie Creeks and their principal tributaries, extending well up toward their headwaters.

Approximately 48 percent of the land in the sub-basin is Federally owned, while 52 percent is private land.

The raising of livestock, almost exclusively cattle at this time, continues to be the dominant agricultural activity. The privately owned lands are used for the production of irrigated crops and range forage. The national land reserve (formerly public domain) is used primarily for spring-fall and summer range for livestock, and as summer range for big game. It also serves as a year-long habitat for other wildlife forms. Recreation use is an important phase of the Bureau of Land Management's program on the national land reserve. One of the principal uses of the reserve lands is as a watershed area, as the major portion of the sub-basin's living streams have their origin on these lands.

Of the 382,400 acres of usable range land (exclusive of barren or inaccessible lands), approximately 202,000 acres are currently in the low forage production class, 161,000 in the medium class, and 19,400 are in the fairly high forage production class. Livestock numbers on ranches in the sub-basin, based upon Bureau of Land Management licenses for 1963, were estimated at 7,000 cattle. The Federal and intermingled private range lands furnish forage for approximately 30,000 A.U.M.'s of cattle, with the Federal

range providing less than half of the spring-fall and summer feed required. The balance of feed is provided by two or more months' grazing on private range lands, crop aftermath, adjacent irrigated pasture, and three to four months on hay.

The average annual precipitation varies from seven inches in the vicinity of Carlin to approximately 25 inches along the Tuscarora Mountain crest. The average frost-free period (28 degrees F) for the irrigated lands is estimated to vary between 120 days in the south to 90 days at the higher elevations to the northward.

Surface irrigation supplies are derived primarily from snowmelt. About 69 percent of the gross water yield originates on the national land reserve in the Tuscarora Mountains.

The annual water balance studies made by the Field Party indicate that during an 80 percent frequency flow year the approximate gross water yield is 12,000 acre-feet. Of this total, 3,100 acre-feet are used to produce hay or pasture, and 2,600 acre-feet are used by phreatophytes of all classes, leaving a remainder of 6,300 acre-feet as discharge to the Humboldt River.

The principal water use in the sub-basin is for the irrigation of 3,300 acres of cropland. Culinary and livestock use, while important, do not require very large quantities of water. There are a number of ponds, wells, and seeps used for stockwater.

The hay lands and phreatophyte areas are located along the stream bottoms. Most of the native hay and pasture land is irrigated continuously during the period of high seasonal stream flow. A small acreage receives water at periodic intervals when available, from springs. On-site requirements by trees, shrubs, and grasses on the watershed are also significant; downstream values are dependent upon a healthy watershed, to prevent flood, sediment and debris damage.

On-the-farm irrigation efficiency is quite low; it is estimated at 20 percent or less on most fields. Seepage loss from surface flow was observed to be fairly high in the Susie Creek channel where it passes over alluvial soils.

There is a limited amount of improved irrigation development in the area, consisting of some land smoothing, land leveling, drainage, diversion structures, spreader ditches, and an irrigation well. The bulk of the irrigation is done by a semi-controlled type of wild flooding. Of the other methods, only a very limited use has been made of border irrigation. Water supplies from surface streams vary widely throughout the irrigation season, which makes water regulation difficult. On some fields, meadow hay and pasture forage receive part of their water needs from shallow ground water.

The principal soils problems on irrigated cropland are high water table, poor drainage, and salt and alkali concentrations. These problems usually occur in the Humic Gley and Alluvial Soils which are found on the flatter slopes in the valley bottoms.

The first specific record of flood damage noted for the sub-basin occurred during the winter and spring floods of 1890, although at least two prior flood periods, 1874 and

1884, probably inflicted flood damages and livestock losses. Since the 1890 flood, there have been six wet-mantle and two dry-mantle floods which have caused major damages. These have been in the form of watershed erosion, stream and gully erosion, cropland sedimentation, damage to irrigation structures, and livestock losses. Damages have also been inflicted on roads, bridges, buildings, and railroad installations and facilities, both within the sub-basin and below it (Maggie Creek and Susie Creek-originated flood crests in the vicinity of Carlin).

Regular Department of Agriculture and other Federal and State programs can provide assistance in accomplishing many needed improvements in the sub-basin. The regular programs of the Bureau of Land Management, including fire protection, provide for the protection and improvement of the Federal lands that agency administers, within the scope of currently available funds.

A review of the sub-basin indicated that the water and related land resources problems in the two watersheds - Susie Creek and Maggie Creek - are such that they can best be handled on a project basis. In these two areas, improvement measures can be installed which will provide for flood prevention, watershed protection, recreation development, increase range forage production, supply supplemental irrigation water, and reduce erosion and sediment damage on the irrigated lands. A preliminary evaluation of the works of improvement proposed for the two watershed areas is favorable enough to warrant a more detailed study.

# HUMBOLDT RIVER BASIN SURVEY

# MAGGIE CREEK SUB-BASIN REPORT

## AUTHORITY AND ORGANIZATION

The need for continually improving the conservation and use of water and related land resources has long been recognized by Federal, State, and local agencies. A recent pertinent development of this continuing interest is River Basin studies under Section 6 of Public Law 566, as amended and supplemented. In Nevada such a survey is underway by the U. S. Department of Agriculture and the Nevada State Department of Conservation and Natural Resources.

The Secretary of Agriculture is authorized under the provisions of Section 6 of the Watershed Protection and Flood Prevention Act to cooperate with other Federal and with State and local agencies in making investigations and surveys of the watersheds of rivers and other waterways as a basis for the development of coordinated programs.

General direction for the U. S. Department of Agriculture in the conduct of the studies and preparation of the report was provided by a USDA Field Advisory Committee composed of representatives of the Soil Conservation Service, Forest Service, and Economic Research Service. The USDA River Basin Representative served as advisor and consultant to the committee.

General direction for the State of Nevada was provided by the Director of the State Department of Conservation and Natural Resources.

A Field Party, composed of representatives of the Soil Conservation Service and the Forest Service, completed the field work and prepared this report.

Grateful acknowledgement is made to all individuals and to the personnel of other State and Federal agencies who gave their counsel and technical assistance in the preparation of this report.

## HISTORICAL INFORMATION

### Settlement

Most of the early use of the lower portions of the sub-basin during the fur trade and westward emigration periods occurred in connection with the use of the adjacent main stem of the Humboldt.

J. A. Palmer took up lands for farming along the Humboldt and lower Maggie Creek in July 1868. The Central Pacific Railroad arrived in December of that year, and established an operating division point at the confluence of Maggie Creek with the Humboldt, naming it Carlin. The town grew rapidly, vying with Elko and Palisade for the stage and freighting business to Bullion, Mineral Hill, Eureka, and other booming mining

camps south of the Humboldt River. North of the river, in 1872 Carlin became a rival of not only Elko, but also Winnemucca and Battle Mountain as a shipping point for the silver, lead, and gold ores from the Cornucopia, Tuscarora, and Bull Run Mining Districts. In September of that year Woodruff & Ennor, the well known staging and freighting firm, built, as a toll road, the present road north from Carlin up Maggie Creek.

From the head of Maggie Creek the road traversed Taylor Canyon to Jack's Valley, Tuscarora, and Cornucopia. The new road furnished Carlin the necessary direct access to the mines of these northern districts. By July 1875, along with the continued increase of mining activity at Tuscarora, there was also a resurgence of interest in Cornucopia, after a short lull. The business of transporting people and freight to these bustling camps grew apace. Woodruff & Ennor, which in 1873 had closed out its Palisade-Pine Valley-Eureka-Hamilton operations with the advent of the Eureka & Palisade Railroad, put on a daily line of six-horse stages between Carlin and Tuscarora-Cornucopia.

The raising of small grains along lower Maggie and Susie Creeks started in 1869; the July 14, 1869 issue of the Elko Independent commented on the luxuriant barley crops being raised on Maggie Creek. This early agriculture was of particular interest because it was all on a dry-farm basis, according to the Independent.

By 1875 livestock raising had supplanted these early small-grain farming efforts. Carloads of cattle were being shipped at Carlin and Beowawe from ranches which included extensive acreages in the sub-basin.

Around 1870 Dr. G. W. Grayson, a San Francisco physician, had started putting together the Horseshoe Ranch at Beowawe, among the oldest and still one of the largest cattle ranches in eastern Nevada. Under the Horseshoe-Bar brand, the ranch owned or controlled over 200,000 acres in Elko, Eureka and Lander Counties. Included was the present upper Horseshoe Ranch on Maggie Creek, which was kept by R. H. Hadley, Jr., when he sold the remainder of the original Horseshoe holdings in 1958. The upper Horseshoe Ranch contains the earliest fenced allotment of intermingled private and national land reserve range in eastern Nevada, totaling over 90,000 acres. This aid to better range management was set up around 1940, when San Francisco financier Dean Witter owned the Horseshoe.

In 1877 the W. T. Jenkins Company was established at Battle Mountain. It grazes cattle and sheep on 278,000 acres of deeded land in Lander, Pershing, and Elko Counties, including the Stampede Ranch on upper Maggie Creek.

In the Susie Creek drainage, Tom and William Hunter ran cattle from the middle or late 1870's. Around 1910, George Hunter, Tom's son, formed a partnership with George Banks. The firm, known as Hunter and Banks, became one of the bigger outfits in eastern Nevada. The home ranch was located on the Humboldt below Elko (present McKinley ranch), but the partners also maintained an operating headquarters on upper Susie Creek. During the peak of its operations, the firm ran at least 5,000 head of cattle on Susie Creek, from its lower reaches to Lone Mountain. A combination of drouth and hard times forced the company's dissolution in 1925.

Besides cattle and sheep, the Maggie and Susie Creek benches and open grassy ridges sustained large horse herds in the early period of range use. The Silver State at Winnemucca noted in its June 18, 1890 issue that approximately 650 head of horses alone had perished in the snows of upper Maggie and Susie Creeks during the preceding "White Winter" of 1889-90.

Mining activity in the sub-basin, although never on the scale of the operations in the adjacent Tuscarora, Cornucopia, Cope or Bull Run Districts, has been carried on at sporadic intervals since 1870. The Merrimac District (silver and lead) on Lone Mountain in the Independence Mountains was established that year. At present, barite (barium ore) is being mined in the Tuscarora Mountains west of the Stampede Ranch in upper Maggie Creek. In 1884 there was a short-lived silver strike in the Schroeder District, 10 miles up Maggie Creek from Carlin. In the Tuscarora Mountains 10 miles further up Maggie Creek, a townsite called Lynn was laid out in March 1913 by the Big Six Mining Company. From all accounts, the site seems to have consisted primarily of a miners' boarding house and a saloon. At this location gold was mined by the company in paying quantities. The mine was near the old Blue Wing silver properties, which had produced for a brief period in 1874. On the strength of glowing reports characterizing the gold vein as one of the largest and richest in Nevada, the Big Six Company proposed a diversion ditch from Lynn Creek and a mill at Lynn. However, the boom was of short duration; by December 1914 the company was in financial difficulties. Another brief upsurge of activity occurred here in 1921, when the Spirit Ore Porphyry Gold Mines Company became interested in the old workings. At the present time (1963) core drill prospecting is still being carried on around the old townsite by a large international mining company.

The Rip Van Winkle mine on the west side of Lone Mountain in the old Merrimac District, true to its namesake, awoke from a long period of quietude in the years 1937 to 1948. During that period it produced profitable amounts of silver, gold, lead and zinc; it has been inactive since 1948.

A managed grazing program on the national land reserve (public domain) lands in the sub-basin was not begun until the establishment of the Grazing Service, now the Bureau of Land Management, in the Department of Interior in 1935. At that time the Elko Grazing District was established to manage these lands.

Two soil conservation districts, Humboldt River and Owyhee, operate in the sub-basin, and provide assistance to ranch operators in the conservation and development of the soil, water, and range resources on privately owned lands. The Humboldt River district was organized in September 1950, and the Owyhee district was formed in February 1946. They are furnished technical assistance by personnel of the Soil Conservation Service at Elko.

## Floods

This sub-basin, along with the rest of the Humboldt Basin, has suffered from recurrent periods of flooding and high water, particularly along the lower Maggie Creek and Susie Creek reaches. The earliest flood year of record along the Humboldt River and its

tributaries, including this sub-basin, was December 1861-January 1862. For further information on the history of the sub-basin's floods and high water periods, refer to the section on flood damage, page 15.

### Fires

Three recent fires have been large enough to be significant causative agents of watershed damage. Two of these occurred in 1955 and one in 1957. The first, the Mary's Mountain fire, in the southwest corner of the sub-basin, burned 700 acres of national land reserve and private lands in September 1955. The second fire, the Coyote Creek, burned approximately 400 acres on upper Coyote Creek, west of Maggie Creek, in October of 1955. The third and by far the most damaging, the Mack's Creek fire, started on July 21, 1957. Before being brought under control it had burned almost 30,000 acres of watershed lands on the Tuscarora Range between Maggie Creek and Mack's Creek, north of Mary's Mountain.

## PREVIOUS STUDIES

### Bureau of Reclamation

A survey was made in this area by the Bureau prior to 1919 and reported on as a portion of their study entitled Humboldt River Investigations issued in 1919.

### Watershed Protection and Flood Prevention

A watershed work plan for the Susie Creek watershed was prepared by a group of Federal, State and local agencies in 1956. This plan contains a combination of land treatment and structural measures designed to contribute directly to soil, plant and water conservation and flood prevention. This plan is pending further action by the local participants.

### Other Studies

Other technical reports covering limited or specialized fields have been made at various times in the sub-basin. Their titles are listed in the reference section of this report.

## GENERAL SUB-BASIN CHARACTERISTICS

The Maggie Creek Sub-Basin lies in the general form of a maple leaf extending north from the main stem of the Humboldt River at Carlin, Nevada. It lies mostly in Elko County, but includes a strip of land in the northeast corner of Eureka County. The area is about 34 miles long and averages about 22 miles wide.

Physiographically the sub-basin includes three land forms: The mountain highlands; the valley uplands; and the valley lowlands. The Tuscarora Mountains form the west boundary. They have crest elevations of about 7,000 feet with peaks of 7,703 feet and 8,786 feet. The south extension of the Independence Mountains forms a divide between Maggie

and Susie Creeks. This range crests around 7,000 feet, with peaks of 8,080 feet at Swales Mountain and 8,802 feet at Lone Mountain. A low ridge connecting the Independence Mountains with the Adobe Range forms the north boundary, and the Adobe Range constitutes the east boundary. This ridge crests around 6,500 feet, and the Adobe Range has peaks of 7,079 feet and 7,466 feet.

The area is drained by Susie and Dry Susie Creeks on the east side of the sub-basin and Maggie Creek on the west. The average gradient of these streams is about 44 feet per mile. The total area is about 609 square miles or 389,800 acres.

## Geology

Consolidated sedimentary rocks of Paleozoic age form the basement complex underlying this area. They crop out in the mountains throughout the sub-basin and include shale, chert, limestone, sandstone, quartzite, and volcanic rock.

Evidences of major low-angle thrust faulting are present on the flanks of Lone Mountain. A trace of the fault, marked by a thick zone of breccia, occurs along Cold Creek south of Lone Mountain.

Partially consolidated deposits of the Humboldt formation, which include stream and lake sediments and interbedded volcanic debris, underlie the uplands and lowlands. The lowlands are overlain by Quaternary alluvium. Thick accumulations of water-deposited volcanic ash are interbedded with lake sediments along Susie Creek.

## Ground Water

Ground water sources are more likely to occur in the deeper aquifers found in the Tertiary alluvial and lake deposits. The more satisfactory irrigation wells would probably be located in the relatively flat broad valley bottomlands, principally in the lower end of the drainages and near the Humboldt River.

## Soils

The soils of the sub-basin are mostly moderately deep to deep, medium or stony and gravelly medium textured, and well to excessively drained. There are some bottomland soils which are moderately fine to fine textured, imperfect to poorly drained, and which have slight to strong salt and alkali concentrations. Above the valley bottoms there are some soils that are shallow over bedrock and some that are moderately deep over a hardpan. (See tables 8 and 9, Appendix I.)

## Precipitation

The only precipitation gaging station in the sub-basin is the storage gage on Adobe Summit (elevation 6,600 feet). Data based on these records along with records from stations adjacent to this area, and the water balance studies, indicate the average annual precipitation in the Tuscarora Mountains would be 25 inches (8,000 to 9,000 feet), 20

inches on Lone Mountain in the Independence Mountains (8,000 to 9,000 feet), and 12 inches in the Adobe Range (6,000 to 7,000 feet). Average precipitation on the irrigated land will vary between seven inches around Carlin to 10 inches in the higher elevations.

Average annual precipitation at points in and around the sub-basin as determined from the U.S. Weather Bureau records is as follows:

| Station | Ave. Precip. | Elevation | Years of record |
|---|---|---|---|
| Beowawe | 6.5 | 4,695 | 92 |
| Palisade | 8.7 | 4,821 | 24 |
| Carlin | 7.1 | 4,900 | 31 |
| Elko | 8.6 | 5,075 | 93 |
| Emigrant Pass Highway Sta. | 8.9 | 5,760 | 9 |
| Tuscarora | 13.7 | 6,000 | 50 |
| | Storage Gage | | |
| Adobe Summit | 9.2 | 6,560 | 9 |
| Willow Creek | 10.8 | 6,370 | 9 |
| Ganz Creek | 11.0 | 6,360 | 12 |

## Growing Season

There are no temperature recording stations within the sub-basin. On the basis of temperature records for similar adjacent areas, the growing season (28 degrees F) for the irrigated lands is estimated to very between 120 days in the south and 90 days at the higher elevations.

## General Cover Types

The predoninant cover over much of the sub-basin is big sagebrush (Artemisia tridentata)-grass. Within this type, low sagebrush (A. arbuscula) is found on large claypan bench sites on the south extremity of the Independence Mountains, lying between Maggie and Susie Creeks. Additional claypan bench areas are found on the benchlands west of Maggie Creek, in the northwest portion of the sub-basin. Extensive areas of black sage (A. nova)-grass are found on the shallow-soiled steep mountain slopes and tops from 6,500 to over 8,000 feet within the intermediate mountain slopes site in the Tuscarora Range, west of Maggie Creek.

Large areas of nonbeneficial phreatophytes, principally rubber rabbitbrush (Chrysothamnus nauseosus), are found along the saline bottomlands on Susie Creek both above and below its narrows. With the exception of the narrows areas, these phreatophytes extend the entire length of the Susie Creek main channel. The few areas of ryegrass meadow still existent, as in the vicinity of the old Huntsman Ranch, the Hunter-Banks Cabin, Sproule Cabin, and the Green Cabin, are rapidly being desiccated by the deep gullies along the main stem of Susie Creek and its principal tributaries, and rabbitbrush is invading. The same desiccation and invasion is taking place on much of Maggie Creek, except

for the areas of improved hay lands above the upper and lower Maggie Creek narrows, on the upper Horseshoe and Stampede Ranches.

The only area of greasewood (Sarcobatus vermiculatus), one of the nonbeneficial phreatophytes occurring in the sub-basin, is found on lower Susie Creek, near its junction with the Humboldt main stem in the vicinity of U. S. 40. Small amounts of willow (Salix spp.), another nonbeneficial phreatophyte, occur as thin stringers lining upper Susie and Maggie Creeks and their tributaries, such as Coon Creek, Lone Mountain Creek, Cold Creek, Blue Basin Creek, and others. However, in many of these locations, the species' present value as a soil binder along the eroding stream channels far outweighs its nonbeneficial water-wasting propensities.

Aspen (Populus tremuloides) grows in scattered stringers along the water courses and in the high basins at the headwaters of Beaver, Coyote, and other streams draining the Tuscarora Mountains. Similar aspen types are found on the west side of Lone Mountain, at the heads of Coon and Lone Mountain Creeks, among others.

Mixed sagebrush-browse-grass is found on the slopes above the high basins and stream bottoms, particularly on the north and east exposures. There are no conifers in the sub-basin, except for scattered clumps of limber pine (Pinus flexilis) along the Lone Mountain crest, and scattered stands of juniper (Juniperus Utahensis) in the Adobe Range north of the Humboldt River.

## Water Yield

Water supply is derived primarily from snowmelt at the higher elevations. Both Maggie and Susie Creeks are relatively early flow streams, occurring during March, April, and May. Peak flows are usually in April and May. (See figure 2.) Flow extremes vary from periods of no flow to peaks of 2,470 c.f.s. on Susie (February 1962) and 2,320 c.f.s. on Maggie (February 1962). About 69 percent of the gross water yield for the sub-basin originates in the Tuscarora Mountains.

Detailed ground water studies have not been made, except for single well locations. At present there is one water well used for irrigation. It is located in the bottomland on the lower end of Maggie Creek, and has an estimated potential capacity of 3,000 g.p.m. (see photograph 1). There are several low-capacity stockwater and culinary wells scattered through the sub-basin.

A flow diagram of gross water yields and depletions for watersheds in the sub-basin is illustrated in figure 1. A water balance summary from the diagram is shown below:

Water Balance Summary

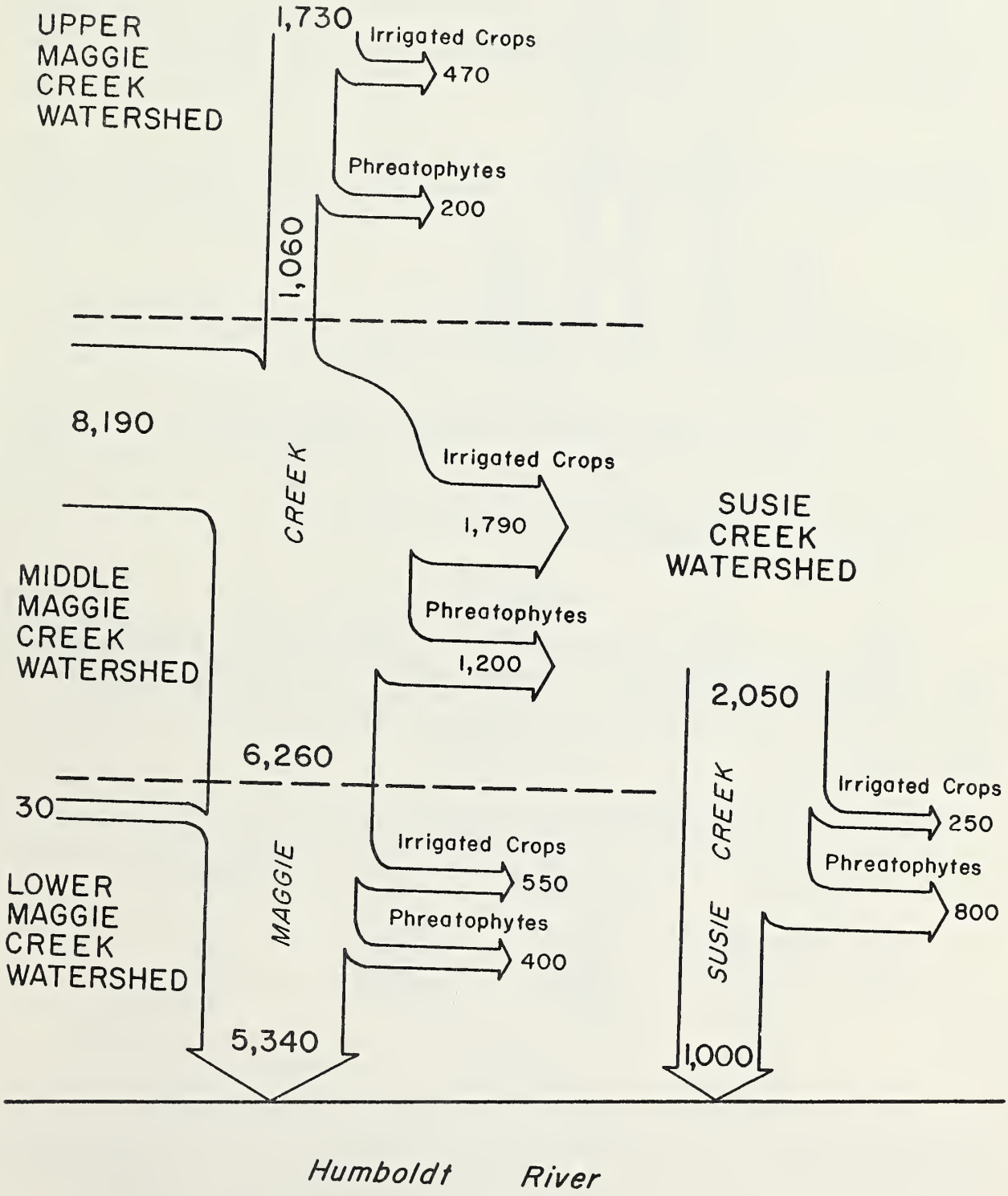
| | Acres | Acre-feet |
|---|---|---|
| Gross Water Yield 1/ | 389,800 | 12,000 |
| Use: Irrigated crops | 3,300 | 3,060 |
| Phreatophytes | 3,900 | 2,600 |
| Discharge to Humboldt River | ----- | 6,340 |

1/ Gross water yield, for the purpose of this study, is the estimated available water, both surface and sub-surface, prior to agricultural and phreatophytic use. Generally, this water yield is estimated for a stream or streams at a point above the highest diversion for the main body of irrigated land on a flood plain of a valley.

*Photograph 1. - The only well developed for irrigation use at the present time in the sub-basin. (Upper Horseshoe Ranch, on lower Maggie Creek.)*

S.C.S. PHOTO--6-479-8

*Figure 1. - Flow diagram of gross water yields and depletions in acre-feet for watersheds in the Maggie Creek Sub-Basin (80% frequency).*




SOURCE: HUMBOLDT RIVER BASIN FIELD PARTY.

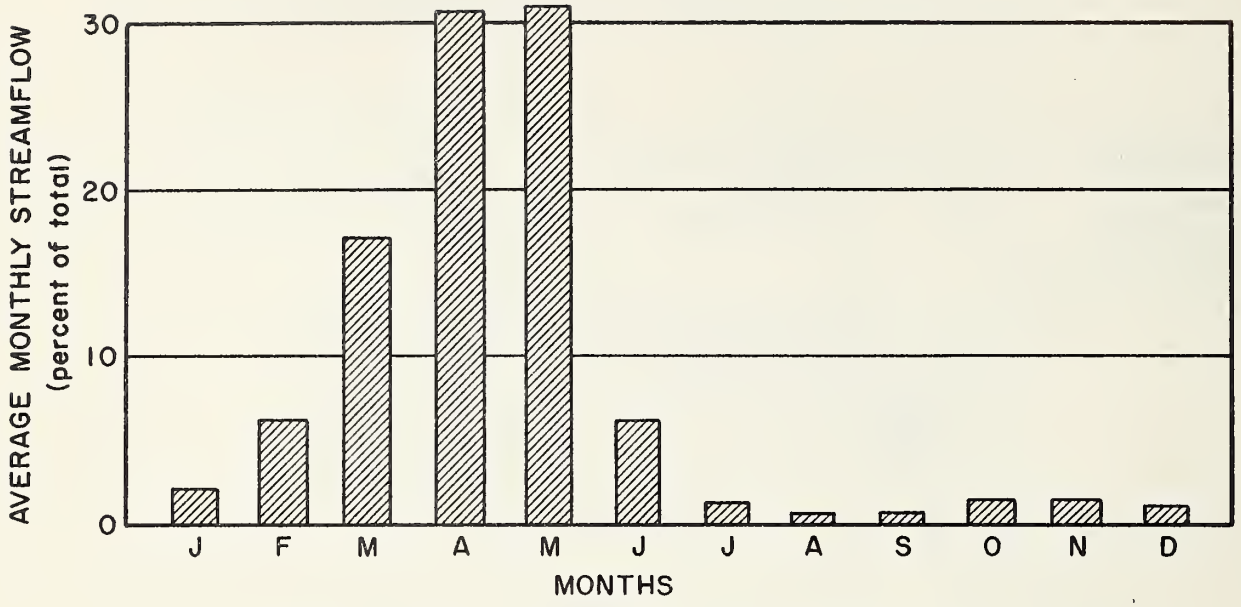



*Figure 2. - Annual streamflow distribution, Maggie Creek*

SOURCE: U.S. GEOLOGICAL SURVEY STREAMFLOW RECORDS 1914-1924

## LAND AND WATER USE

### Land Status

There are at present 32 land owners in the sub-basin, according to records of the Bureau of Land Management at Elko. Sections of Federal and private (formerly railroad) lands are intermingled in a checkerboard pattern in the southern two-thirds of the sub-basin. Included in the private land are an estimated 8,700 acres owned by the Southern Pacific Land Company.

The land status breakdown is as shown below:

| Land Status | Square miles | Acres | % of total |
|---|---|---|---|
| National Land Reserve | 293.8 | 188,000 | 48.2 |
| Private | 315.3 | 201,800 | 51.8 |
| Total | 609.1 | 309,800 | 100.0 |

### Land Use

The national land reserve lands are used primarily for spring-fall and summer range for domestic livestock. It also serves as summer range, primarily, for big game and as a year-long habitat for other wildlife. Recreation is an important phase of the Bureau of Land Management program. The long range land program includes the encouragement of land exchanges, in order to establish a more desirable land pattern, particularly on the higher watershed lands. The Bureau's proposed recreation development program is briefly

outlined in table 3.

Private lands are used for the production of irrigated hay and pasture and range forage. Some of the range land in the higher mountains is part of the water-yielding area. In many instances exchange of use agreements are granted the owners of private intermingled lands and these areas are then administered with public lands by the Bureau of Land Management. The bulk of the current grazing on national land reserve range is on individual and small group allotments.

The acreage of land irrigated and the acreage of cropland harvested vary widely from year to year depending on precipitation and stream flow. Practically all the irrigated land is used to produce winter feed for livestock.

## Water Rights

Water rights were established by the Edwards Decree of 1935 and subsequent permits from the State Engineer's office. In general, the decree provides for a flow of 1.23 c.f.s. per 100 acres of decreed land, or at proportional rates. The duty of water is represented in the following table, showing the acre-feet of decreed water and the acres of decreed land in the sub-basin:

| Class of land | | Dates of use | Number of days | Decreed water (acre-feet) | Decreed land (acres) |
|---|---|---|---|---|---|
| Harvest crop | (A) | 4/15-8/15 | 120 | 5,855 | 1,962 |
| Meadow pasture | (B) | 4/15-6/15 | 60 | 811 | 540 |
| Diversified pasture | (C) | 4/15-5/15 | 30 | 985 | 1,335 |
| Total | | | | 7,651 | 3,837 |

## Water Use

The annual water balance studies made by the Field Party show that during an 80 percent frequency flow year the approximate gross water yield (available water prior to irrigated crop and phreatophyte use) is used as follows:

| | Acres | Water use acre-feet |
|---|---|---|
| Irrigated crops | 3,300 | 3,100 |
| Phreatophytes | 3,900 | 2,600 |
| Discharge to Humboldt River | ----- | 6,300 |
| Total | | 12,000 |

## Surface Water

The dominant use of water is for irrigation. Culinary and stock water use, while of strategic importance with respect to location, quality, and availability, do not require

very large quantities. There are a number of ponds, wells, and seeps used for stockwater.

The hay lands and phreatophyte areas are located along the stream bottoms. Most of the native hay and pasture land is irrigated continuously during the period of high seasonal stream flow. A small acreage receives water at periodic intervals from several springs.

While use of water for irrigation and other downstream needs is highly important, the on-site requirements are also significant. Trees, shrubs, and grass require water to remain vigorous and keep the watershed in a good hydrologic condition. Downstream values are dependent on a healthy watershed to prevent damages from floods, sediment and debris. The water used to satisfy on-site requirements, not shown in the above table, is that quantity which is retained in the soil. In addition, water is needed in streams for fish, aesthetic values, recreation activities, livestock, and game animals. Other on-site uses of water in the sub-basin are minor.

### Ground Water

About 130 acres of alfalfa-grass on lower Maggie Creek are irrigated in the spring by surface flow, and supplemented later in the season with water from one well. The well has an estimated capacity of 3,000 g.p.m. and is currently producing 2,000. Other ground water use is by phreatophytic plants (3,200 acre-feet) and several low-capacity stockwater and farmstead wells.

### Irrigation Methods

There is a limited amount of improved irrigation development in the area. These developments consist of some land smoothing, land leveling, drainage, diversion structures, spreader ditches, and one well.

Irrigation is principally by a semi-controlled type of wild flooding. Of the other methods only limited use has been made of border irrigation. Water supplies from surface streams vary widely throughout the irrigation season, which makes the regulation of water difficult. During the high runoff period streamflow is either diverted or spreads out over meadow and pasture lands naturally. Ditches are used to spread the water over the land. Water is generally kept on the fields much longer than is needed to saturate the soil; this results in low irrigation efficiency, loss of fertility, and lower yields. On some fields meadow hay and pasture forage receive part of their water needs from shallow ground water.

## THE AGRICULTURAL INDUSTRY

Agriculture is dominated by the range livestock industry. Currently, livestock enterprises consist almost entirely of production and sale of feeder cattle. Livestock numbers on sub-basin ranches, based on Bureau of Land Management licenses for 1962, were estimated at 7,000 cattle.

Federal lands provide slightly less than one-half of the spring-fall and summer feed

for the breeding herds. Of the total livestock feed required, the Federal and intermingled private rangelands furnish forage for approximately 31,000 AUM's of cattle. The balance of feed is provided by two or more months' grazing on private range land, crop aftermath, adjacent dry and irrigated pasture, and three to four months of hay.

### Markets

The livestock shipped from the area constitute the only agricultural export of significance. They are mostly sold on the ranch to outside buyers and shipped to destination by truck at the buyer's expense. Cattle sold are chiefly calves, long yearlings, and cull cows consigned to feed yards in the neighboring States. It is estimated that more than 80 percent of livestock go to California for slaughter or to the feed lots, with the remainder going to southern Idaho, Oregon and small numbers to feed lots in other western and mid-western states.

### Transportation

Transportation facilities available to the area are adequate. Two interstate rail lines, Southern Pacific and Western Pacific, serve the area and provide daily schedules from Elko and Carlin to the west coast and to Ogden and Salt Lake City and points east. Both railroads offer livestock transportation service, with loading facilities at Carlin and Elko.

Several motor freight common carriers maintain terminals in Elko, provide pick-up and delivery service at Carlin, and interstate service to all parts of the nation.

Livestock transportation service is provided by local truck carriers, as well as by a number of truck carriers from Idaho and California.

Transcontinental U. S. Highway 40 (Interstate 80) at Elko and Carlin links the area with all eastern and western points. Nevada Highway 20 connects U. S. 40 at Carlin with U. S. Highway 50 near Eureka. Nevada Highways 43 and 11 link U. S. 40 with points in southern Idaho and Oregon. A county road extends up Maggie Creek for an estimated 33 miles. Numerous other roads and truck trails provide access to most parts of the area, at least during good weather.

Air transportation is available at Elko, with United Airlines providing a daily flight schedule - one east and one west. Charter airplane service is also available at Elko.

## WATER-RELATED PROBLEMS IN THE SUB-BASIN

### Agricultural Water Management

#### Seasonal Distribution of Water

Maggie and Susie Creeks are early-flow streams. Runoff usually occurs from March

through May, with peak flows in April.

Irrigated lands, for the most part, receive but one irrigation from surface flow during the spring runoff. Generally, these conditions result in the production of low-yield forage plants which will tolerate wide extremes in soil moisture over extensive periods of time. The exception is the small acreage of land on Maggie Creek which receives additional water from springs and one well.

## Soils

The principal soils problems on irrigated land are high water table, poor drainage and salt and alkali concentrations. These problems usually occur in the Humic Gley and Alluvial Soils which are found on the flatter slopes in the valley bottoms.

The thinning of the vegetal cover on the range areas, particularly on the upland bench and terrace and intermediate mountain slope sites, has led to considerable topsoil loss through sheet erosion. This has resulted in gravel-paved surfaces, and loss of humus and soil fertility.

## Control of Water

Obstructions in the creek channels divert stream flow over hay lands or into irrigation ditches during the runoff period (see photograph 2). It is difficult to regulate irrigation water needs with these uncontrolled diversions. In most fields, additional ditches, gates, and other control structures are needed for better water distribution.

*Photograph 2. - One type of obstruction commonly used to divert stream flow into irrigation ditches or over hay lands. (T. S. Ranch, Maggie Creek.)* S.C.S. PHOTO--6-313-11

### Irrigation Efficiency

On-the-farm irrigation efficiency is quite low; it is estimated at 20 percent or less on most fields. Some of the conditions that contribute to this problem are: Continuous flooding of fields during periods of high stream flow; undulating field surfaces; and poor seasonal distribution of water.

### Seepage Loss

Water loss from surface flow to ground water was observed to be fairly high in the Susie Creek channel flowing over alluvial soils; this is also true on Maggie Creek, below the lower narrows.

### Drainage

Salt and alkali concentrations, and high water table in some areas, limit the type of crops that can be grown, and the crop yields. Some of the trouble spots are caused by over-irrigation of lands upstream and others by returning ground water.

## Flood Damage

Through the years of recorded flood damages, Maggie and Susie Creeks and their tributaries have suffered more than most of the Humboldt Sub-Basins. Of the two types of floods - wet-mantle and dry-mantle - which have produced damage, the wet-mantle winter floods have inflicted the greatest amount of recorded flood, erosion, and sediment damage. The dry-mantle type has occurred less frequently, typically during the summer months, and is usually localized at the stream sources on the higher watersheds.

### Wet-Mantle Floods

The first specific record of flood damage found for the sub-basin occurred during the wet-mantle floods of 1890. However, damages and livestock losses were undoubtedly incurred prior to this flood period, particularly during the system-wide wet-mantle floods of May - June 1884. Severe flooding occurred in Carlin, Palisade and Beowawe along the Humboldt main stem at that time. Maggie and Susie Creeks contributed their share to these high waters.

March 7 - June 5, 1890. - Maggie and Susie Creeks both flooded, inundating low-lying sections of Carlin. Cattle losses occurred from miring, drowning, starvation, etc. (Approximately 650 head of horses perished in the heavy snows of 1890 prior to the flood period, on upper Susie and Maggie Creeks.) No specific mention of soil or stream channel erosion has been found, although some undoubtedly occurred.

February 18 - March 15, 1910. - Carlin was again flooded, not only from Maggie and Susie Creeks, but also in its low-lying sections by high waters on the Humboldt itself. This was probably the greatest flood for this sub-basin, as recorded in newspapers and other historical sources, with the possible exception of the 1943 and 1962 wet-mantle

floods. There are no stream gage recordings available from the sub-basin for 1910. Many of the present eroded channels on Maggie and Susie Creeks and their tributaries probably had their inception at this time, although this fact has not been conclusively established.

January 1 - April 1, 1914. - Some flooding at Carlin from Maggie and Susie Creeks; floodwaters encroached upon Southern Pacific and Western Pacific railroad grades there.

April - June 1922. - For the Maggie Creek watershed, at least, this period apparently should be included in the wet-mantle category. For most of the Humboldt Basin, the spring of 1922 was not classified as a wet-mantle flood year, with the possible exception of the Little Humboldt Sub-Basin, where semi-flood conditions did develop that spring. Along the major portion of the Humboldt River system, dry, unfrozen soil underlying the heavy snowpack accumulated during the winter of 1921-1922 absorbed the major portion of the spring snowmelt, preventing extensive flooding. However, on Maggie Creek, and possibly on Susie Creek, as along the Little Humboldt, flood or semi-flood conditions did develop, as the highest discharge previously known on Maggie Creek, prior to the 1962 wet-mantle flood, occurred on May 7, 1922.

April 3 - May 1, 1942. - Localized flooding on lower Maggie and Susie Creeks from melting of deep snow accumulations higher in the sub-basin by warm rains on April 3 and 4.

January 1 - 27, 1943. - Carlin partially covered by water from Maggie and Susie Creeks; a foot of water flowed over both the Southern Pacific and Western Pacific tracks, undermining them. Train movements were severely hampered thereby, for a short period. Cellars and some ground floors of residences were flooded. The Susie Creek floodwaters capsized an automobile two miles north of Carlin, but the driver escaped injury. The Pacific Fruit Express ice pond on the Southern Pacific was so badly flooded by Maggie Creek that the levee was opened to save the icing installations. As a result, the entire 1943 ice crop was lost. The Pacific Fruit Express ice house was badly undermined by the Maggie Creek floodwaters.

The 1943 flood produced, at least until the February 1962 crests, the greatest floods recorded on many of the stream gages along the Humboldt and its tributaries. No stream flow measurements are available on either Maggie or Susie Creeks for this period; measurements on adjacent tributaries lead to the assumption that such was also the case here. (No stream records are available for most of the Humboldt Basin in 1910.)

February - May 1952. - The breakup of the heavy winter of 1951-52. At Carlin, Maggie Creek, swollen from its usual two to three foot depth to a boiling torrent seven to eight feet deep, started washing the Southern Pacific tracks. Train movements on this important transcontinental rail link were hampered for some time. The tracks were saved by an extensive job of sand-bagging.

February 9 - 13, 1962. - Portions of the Southern Pacific yard and facilities at Carlin were flooded by ice jams and high water on Maggie and Susie Creeks on February

11-12 (see photograph 3). The Carlin crossover track between the Southern Pacific and Western Pacific main lines was flooded by these streams and put out of use during that period, severely hampering train movements on both railroads. Two trappers working on Maggie Creek lost all their equipment, and several homes in Carlin were flooded.

In addition to the years of known wet-mantle flood damage recorded above, the flood years of 1870, 1881, 1884, and 1917 probably produced at least some flood damages in the sub-basin. However, these periods were not included here because of a lack of definite information covering damages.

Dry-Mantle Floods

July 13 - 25, 1874. - This is perhaps the earliest record of the classic pattern of summer dry-mantle flooding along the Humboldt. Localized but severe flooding occurred along the upper Humboldt, particularly on July 25, including the Elko-Carlin-Beowawe area.

August 12 - 16, 1941. - Torrential summer rainstorms all along the Humboldt and the eastern Sierra Nevada resulted in localized, brief, but heavy flooding and damage from flash overland flows, gullying, and sedimentation. On the Humboldt, the area most affected was in the southern Tuscarora Mountains, from Carlin to Beowawe, including the lower portions of this sub-basin.

August 6 - 28, 1961. - Damage resulted from overland flows, gullying and sedimentation, particularly on the poorly vegetated lower reaches of the sub-basin, from two storms in particular: August 6 and the night storm of August 12-13.

*Photograph 3. - Flood debris and remnants of the ice jam at the Susie Creek bridge, U.S. Highway 40. Looking west toward Carlin, Nevada, February 12, 1962.* S.C.S. PHOTO--6-657-5

## Vegetal Conditions

### Range and Watershed

Watershed conditions in this sub-basin, particularly along Susie Creek, are deteriorated, and the area is producing far below its potential. Table 1 indicates the acreage by soils for each vegetal type and site. The rates in this table are indicative of the total annual forage production, and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the administrative agency.

Exploitation and abuse of the range resource by domestic livestock and by big game have adversely affected the watershed cover. Perennial grasses - bluebunch wheatgrass (Agropyron spicatum), Idaho fescue (Festuca Idahoensis) and Nevada bluegrass (Poa Nevadensis) - once constituted a thick understory to the sagebrush-grass and mixed browse-grass cover types on the benches, terraces, and slopes, according to early accounts and the statements of pioneer stockmen using this area. These decreaser (desirable) forage species are now found in significant quantities only on protected, remote, or inaccessible relict areas in the higher reaches of the Independence Range and the Tuscarora Mountains.

Through grazing overuse, primarily by transient California sheep bands from approximately 1900 to 1938, most of the climax perennial grass-forb understory has been replaced by cheatgrass (Bromus tectorum) and such increaser (less desirable) species as big sagebrush, Sandberg bluegrass (Poa secunda), bottlebrush squirreltail (Sitanion hystrix), and small amounts of Thurber needlegrass (Stipa thurberiana).

Much of the Great Basin wildrye-bluegrass-wheatgrass-sedge cover of the former saline bottomlands along Maggie and Susie Creeks and their tributaries has disappeared through overuse and the resultant desiccation by meadow channeling (see photograph 4). Prior to the "White Winter" of 1889-90 the Great Basin wildrye meadows were thickly vegetated, with the wildrye extending well up on the adjacent hillsides, according to eye-witness descriptions.

After 1890, with the institution of winter feeding of cattle, these ryegrass meadows were cut for hay during the summer months, as well as being grazed during the fall and winter. By 1895 this heavy double use had begun to decimate the meadows. The Great Basin wildrye began to decrease rapidly, being replaced by the inferior sod-forming creeping wildrye (Elymus triticoides), and western wheatgrass (Agropyron smithii), and worst of all, by an overstory of relatively undesirable rubber rabbitbrush, with increasing acreages of greasewood and saltgrass spreading over the more saline or alkali-laden sites. After the wet-mantle floods of 1910 the desiccation of these former grass-clothed bottoms started in earnest, as a result of the inception of the present well-developed gully system on both the Maggie and Susie drainages.

The areas of medium or fairly high forage yields are found primarily on the less accessible middle and upper slopes of the Tuscarora, Independence, and Adobe Ranges. The

most extensive acreage of these better forage production classes is found along the Swales Mountain extension of the Independence Range between Maggie and Susie Creeks, and on the upper benches and intermediate mountain slopes of the Tuscarora Range, west of Maggie Creek (see table 1).

Phreatophytes

The phreatophytes of low economic value consist largely of rabbitbrush, greasewood and willow, (usually rabbitbrush here) in mixed or practically pure stands (see photograph 5). The occurrence and development of these species in the sub-basin are fully discussed under General Cover Types, in the preceding pages of this report. Under or between the rabbitbrush will usually be found an understory of Great Basin wildrye of varying density, with bottlebrush squirreltail and a perennial mustard (Thelypodium) along with worthless annual forbs. These areas are uniformly in the low production class.

Saltgrass comes in as an understory to the ryegrass, replacing it on the most saline areas, as in the greasewood type along lower Susie Creek, in the vicinity of U. S. 40 (Interstate 80) near Carlin.

As noted in the discussion of general cover types, small acreages of willow occur as thin stringers lining the upper tributaries of both Susie and Maggie Creeks, as well as along the upper reaches of Maggie and Susie themselves. (See table 2.)

## Timber Management

There are no commercial sawtimber stands within the sub-basin. The Bureau of Land Management has no commercial timber cutting on the national land reserve, as there are no stands of pinyon or mountain mahogany here, or commercially valuable juniper. The thin, widely scattered stands of aspen are most valuable as protection types or for their aesthetic value and shade.

## Fire Protection

Range fires in the immediate past have caused widespread watershed damage in the sub-basin, and remain an omnipresent threat. With deterioration or destruction of the original plant cover, whether brought about by fire or other watershed abuse, the vegetal types coming in increase the fire hazard by providing flash fuels. Fires on the steep, brush-covered, thin-soiled slopes of the Independence Mountains and the Tuscarora Range could be seriously damaging to these important water-yielding areas.

As time goes on, risks of fires caused by the rapidly increasing recreation and hunter use of the watershed lands will continue to mount. The significance of these water-yielding lands to the arid valleys below makes fire protection a factor of increasing importance. Prevention or prompt suppression of potentially disastrous range fires is now and will continue to be an important facet of resource and watershed management.

Table 1. -- Acreage of present annual forage plant production classes, grouped by soil associations for each vegetal type and site, Maggie Creek Sub-Basin

| Vegetal type and site | Acreage of forage plant production classes | | |
|---|---|---|---|
| 1. Rabbitbrush-greasewood-grass; saline bottomland | Production classes (pounds per acre) 1/ | | |
| | 850-1,500 | 200-900 | 20-300 |
| Soil associations | (acres) | (acres) | (acres) |
| A14-A13 | ----- | ----- | 7,410 |
| A14-H2 | ----- | 100 | 3,910 |
| H2-H4 | ----- | ----- | 9,850 |
| Subtotal | ----- | 100 | 21,170 |
| 2. Big sagebrush-grass; upland benches and terraces | Production classes (pounds per acre) 1/ | | |
| | 250-600 | 100-450 | 20-150 |
| Soil associations | (acres) | (acres) | (acres) |
| B1-R1-L4 | ----- | ----- | 2,300 |
| B10-B11-B3 | ----- | 400 | 15,100 |
| B10-B11-B3-C2 | 400 | 16,400 | 43,300 |
| B11-C2-S3-L3 | ----- | 1,500 | 3,600 |
| C4-B10-L1 | ----- | 8,800 | ------ |
| C4-B10-L10 | ----- | 1,000 | ------ |
| L12-B3-C1 | ----- | 2,060 | 13,400 |
| S3-S4-B10-T1 | 2,200 | 10,600 | 50,500 |
| S10-S3-B11 | ----- | 1,170 | ------ |
| S11-B2-Y2 | ----- | ----- | 10,900 |
| Subtotal 2/ | 2,600 | 41,930 | 139,100 |
| 3. Low sagebrush-grass; claypan bench | Production classes (pounds per acre) 1/ | | |
| | 200-500 | 100-250 | 50-150 |
| Soil associations | (acres) | (acres) | (acres) |
| B10-B11-B3 | ----- | 600 | 900 |
| B10-B11-B3-C2 | ----- | 4,500 | 3,400 |
| C4-B10-L1 | 7,900 | 14,800 | 3,300 |
| C4-B10-L10 | ----- | 8,500 | ----- |
| L12-B3-C1 | ----- | 15,200 | 500 |
| S3-S4-B10-T1 | ----- | 1,200 | 400 |
| Subtotal 3/ | 7,900 | 44,800 | 8,500 |

Continued

Table 1. -- Acreage of present annual forage plant production classes, grouped by soil associations for each vegetal type and site, Maggie Creek Sub-Basin -- continued

| Vegetal type and site | | Acreage of forage plant production classes | | |
|---|---|---|---|---|
| 4. Browse-aspen-grass intermediate mountain slopes | | Production classes (pounds per acre) 1/ 300-650 | 150-350 | 50-200 |
| Soil associations | | (acres) | (acres) | (acres) |
| B1-L1-B4-C4 | | ----- | 4,900 | 1,200 |
| C4-B10-L1 | | 2,100 | 23,700 | 25,400 |
| C4-B10-L10 | | 3,800 | 3,400 | ------ |
| C4-B10-L11 | | ----- | 4,700 | 1,500 |
| R12-L10-C1 | | 3,000 | 35,000 | 4,100 |
| L12-B3-C1 | | ----- | ------ | 300 |
| | Subtotal 4/ | 8,900 | 71,700 | 32,500 |
| 5. Pinyon-juniper-grass; shallow stony slopes | | Production classes (pounds per acre) 1/ 100-250 | 50-150 | 10-75 |
| Soil associations | | (acres) | (acres) | (acres) |
| C4-B10-L11 | | ----- | 1,000 | ----- |
| S3-S4-B10-T1 | | ----- | 1,500 | 700 |
| | Subtotal | ----- | 2,500 | 700 |
| | Total | 19,400 | 161,030 | 201,970 |

1/ These figures indicate total annual forage production (dry weight), and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the administrative agency.

The rates represent production variance from poor years to good years. At higher elevations within the site, with greater precipitation the rates would be higher.

2/ Does not include 1,200 acres of barren or inaccessible.

3/ Does not include 300 acres of barren or inaccessible.

4/ Does not include 2,600 acres of barren or inaccessible.

Source: Humboldt River Basin Field Party.

Table 2. -- Phreatophyte acreage and annual ground water use, Maggie Creek Sub-Basin 1/

| Species | Height class | Density | Acreage cropland | Acreage range types 2/ | Annual ground water use 2/ (feet) | Annual ground water use 2/ (acre-feet) |
|---|---|---|---|---|---|---|
| Willow | 8-12' | .2-.3 | ----- | 240 | 2.2 | 530 |
| Rose | 3-8' | .2-.3 | ----- | 90 | 1.5 | 140 |
| Black greasewood | 3'+ | .04 | ----- | 20 | .3 | 10 |
| Rubber rabbitbrush | 3'+ | .04-.08 | ----- | 2,240 | .3 | 670 |
| Saltgrass | ---- | .04-.25 | ----- | 120 | .5 | 60 |
| Great Basin wildrye | ---- | .04-.3 | ----- | 1,190 | 1.0 | 1,190 |
| Subtotal | | | | 3,900 | | 2,600 |
| Irrigated meadow hay and pasture 3/ | ---- | ------- | 700 | ----- | .3 | 200 |
| Wet meadow 3/ | ---- | ------- | 800 | ----- | .5 | 400 |
| Subtotal | | | 1,500 | | | 600 |
| Total | | | 1,500 | 3,900 | | 3,200 |

1/ These values when referred to in the text are rounded.
2/ These values are based on natural stand densities and 100 percent composition, for each species, except for the irrigated and wet meadows.
3/ Mixture of Great Basin wildrye, creeping wildrye, creeping wildrye, sedges, and other grasses.

Source: Humboldt River Basin Field Party.

*Photograph 4. - Deep channel incision along Swales Creek, one of the Susie Creek tributaries. As a result of meadow desiccation by this gully, worthless rubber rabbitbrush has replaced the former Great Basin wildrye along the stream bottom.* S.C.S. PHOTO--F-32-6

*Photograph 5. - Rubber rabbitbrush phreatophyte type, upper Maggie Creek bottom, looking north.* FIELD PARTY PHOTO--6-792-6

# RECREATION AND WILDLIFE

## Recreation Developments

The recreation potential of this sub-basin is limited because of the land ownership pattern. The absence of outstanding scenic, recreation, or even historic attractions, coupled with the posting of private lands and the closure of access roads in portions of the sub-basin to public use during most of the year, hinders the development of the recreation potential the sub-basin possesses.

### National Land Reserve

There are at present no developed recreation facilities on the national land reserve within the sub-basin. The Bureau of Land Management, in its recreation inventory report prepared in 1959, proposes the development of several camp and picnic areas here. (See table 3.)

## Wild Life

### Deer and Other Big Game Hunting

This sub-basin is a fairly important area for mule deer. During the hunting season the deer migration southward through the area provides hunting for many people from Elko and Carlin. Some deer from the Independence Range traverse Maggie and Susie Creeks toward their winter range in the vicinity of Union Summit, in the Sulphur Springs Mountains, while others drift into the winter range areas between Swales Mountain and Carlin Canyon. A few deer are found during the summer in the willows and fields along Maggie Creek, but generally summer populations are limited to the higher elevations in the Tuscarora Mountains and on Lone and Swales Mountains.

The winter range in Carlin Canyon has deteriorated badly in past years from deer over-population. This is evidenced by the obvious high-lining of juniper and by the presence of badly hedged remnants of bitterbrush. Milder winters in recent years, coupled with reduction of wintering deer, have afforded some relief to this range, however. Tagging studies have shown that deer from this winter range have spent their summers as far north as the Wildhorse Reservoir and Petan Ranch areas.

Access roads for hunting are generally adequate in Maggie Creek, but are less than adequate in the Susie Creek area.

### Fishing

At the time this portion of the upper Humboldt Basin was first settled by whites, both Maggie and Susie Creeks were noted for their fine fishing. The Elko Independent for June 30, 1869 noted that small boys were catching long strings of fine, delicious cutthroat trout along Maggie and Susie Creeks and stretches of the Humboldt River adjacent to Carlin. In the light of this statement, fishing conditions and fish populations here have

Table 3. -- Potential developments, recreation inventory report, 1959, national land reserve, Maggie Creek Sub-Basin

| Site name and type of development | Acres | Road devel. cost (dols.) | Miles | Construction cost (dols.) | Right of way acquisition cost (dols.) | Yearly maint. cost (dols.) | Trails Miles | Trails Devel. cost (dols.) | Water devel. cost (dols.) | Total devel. cost (dols.) | Area affected acres BLM | Area affected acres Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Blue Basin camp site | 1 | 500 | 9 | 3,600 | 1,000 | 135 | -- | --- | 300 | 5,100 | 160 | --- |
| Swales Mountain cabin site | 1 | 4,600 | 12 | ----- | ----- | 180 | -- | --- | Inc. in site dev. cost | 4,600 | 640 | --- |
| Rip Van Winkle Mine camp site | 1 | 500 | 12 | ----- | ----- | 180 | -- | --- | 400 | 1,100 | 80 | --- |
| Big Six (Lynn) camp and gold panning site | 1 | 500 | -- | ----- | ----- | 90 | -- | --- | 300 | 800 | 640 | --- |

Source: Bureau of Land Management, Elko District.

obviously taken a radical turn for the worse in the past 90 years. Very little fishable water now exists in the sub-basin. Susie Creek is considered nonfishable for its entire length. Maggie Creek, Beaver Creek and Coyote Creek have a total of 12 miles of water classified as fishable. Even these waters are probably marginal for trout, because of low late summer flows and relatively high temperatures.

Maggie Creek has been stocked with almost 4,000 pounds of reared rainbow, brook and brown trout in recent years, but has failed to develop as a satisfactory fishery. The brook and rainbow trout disappeared almost immediately, while the browns persisted a year or two after stocking. Tagged brown trout in 1956 yielded only a 10 percent return to the angler. Two thousand channel catfish were stocked in Maggie Creek in 1961 in an effort to establish a warm water fishery; it is as yet too early to predict the outcome of this stocking. In common with other streams of the sub-basin, serious erosion has decreased the potential of Maggie Creek for fishing.

Beaver Creek is considered fishable only in the upper canyon area. It presently supports a cutthroat trout population which is very little used by anglers. The Nevada Fish and Game Department's 1957 stream survey report on this water makes the following point: "...good watershed management practices would greatly benefit this creek...".

Coyote Creek also supports a meager cutthroat trout population in its upper reaches. Both Coyote and Beaver Creeks supported heavier fish populations and more fishing pressure ten years ago than at present. However, the beaver were removed, and the dams which formerly held large numbers of trout were washed out and destroyed.

Small Game

Two upland game birds are of considerable importance in this sub-basin. The sage grouse is present throughout the area, and is fairly common in the meadows along Maggie Creek. With the lowering water table and consequent decrease in meadows caused by gullying of stream channels, it is probable that population levels are now lower than in past years. This would certainly be true of the Susie Creek drainage.

The introduced chukar partridge has established itself very well in this area. Populations are high in the canyons of the Tuscarora Mountains and those on Lone and Swales Mountains.

Valley quail, mountain quail and Hungarian partridge are occasionally seen in these drainages, but are nowhere abundant. Mourning doves and cottontail provide some hunting in this sub-basin every year.

## PROGRAMS OTHER THAN PROJECT-TYPE DEVELOPMENTS AVAILABLE FOR THE IMPROVEMENT OF WATER AND RELATED LAND RESOURCES

Lands in the sub-basin can be treated or can receive aid for treatment under existing U. S. Department of Agriculture and other Federal and State programs. The Bureau of Land Management is responsible for range, recreation, and watershed development on the Federal lands it administers. The owners of private land can receive aid for water and related resources development by means of various programs under the U. S. Department of Agriculture.

Most of the area, however, has water and related land resource problems which appear to lend themselves to project-type development under the Watershed Protection Act.

### Technical Assistance and Cost-Sharing Under Public Law 46

Under the provisions of Public Law 46 the Soil Conservation Service furnishes technical assistance through Soil Conservation Districts, and the Agricultural Conservation Program of the Agricultural Stabilization Conservation Service provides cost-sharing. Under these programs, assistance in developing coordinated conservation plans and in applying conservation measures may be furnished for farms and ranches. These plans provide for soil surveys, land use adjustments, erosion control, water conservation, irrigation, drainage, flood prevention, and recreation development. Solution to the sub-basin problems on private land may be arrived at in part by these programs.

The Soil Conservation Service has the responsibility for leadership in the National Cooperative Soil Survey. With the assistance of several cooperative groups and agencies in this work, soils maps and survey reports will be published in the regular schedule of soil survey publications of the U. S. Department of Agriculture.

### Agricultural Water Management

There are many ways of improving water management on individual ranches throughout the sub-basin. Some of the treatments for various types of problems are listed below.

| Problems | Suggested treatment |
|---|---|
| 1. Limited water supply. | a. Develop irrigation water by drainage of seeps, springs and high water table.<br>b. Control phreatophytic plant growth.<br>c. Construct overnight storage reservoirs to better utilize small flows for irrigation.<br>d. Clear stream channels of all obstructions and install controllable diversions. |

| | | |
|---|---|---|
| | | e. Development of irrigation water wells and irrigation storage reservoirs where investigation reveals their feasibility. |
| | | f. Line or seal ditches through reaches of excessive seepage loss. |
| | | g. Stop applying water to fields after soil reaches saturation. |
| 2. | Saline soils. | a. Install drains to lower water table. |
| | | b. Use only good quality water for irrigation to reduce salt concentration in the soil. |
| | | c. Use proper soil and water management practices. |
| 3. | High water table. | a. Install suitable drainage. |
| | | b. Improve creek channels for drainage outlets, and reduce frequent flooding of bottomland. |
| | | c. Check the possibility for pump drainage. This may increase water supply for irrigation. |
| | | d. Land smoothing to remove low ponding areas. |
| | | e. Line and seal ditches. |
| | | f. Stop applying water to fields after soil reaches saturation. |
| 4. | Low-efficiency use of water. | a. Level or smooth land for even water application. |
| | | b. Reorganize water distribution and irrigation systems. |
| | | c. Line ditches through highly permeable soils. |
| | | d. Stop applying water when soil becomes saturated. |
| | | e. Plant high-yielding crops suitable for conditions, to reduce irrigated acreage now needed for hay production. |
| 5. | Inadequate water distribution systems. | a. Remove "tight dams" and install controlled diversions. |
| | | b. Reorganize water distribution systems. |
| | | c. Use lined ditches or pipe lines through highly permeable soils. |
| | | d. Construct necessary control structures in ditches. |

## Vegetal Improvement

Stream bank cutting and channel erosion as well as watershed erosion on privately owned land indicate the need for action to reverse the trend toward meadow desiccation and land deterioration. Each of the following solutions would contribute in some measure to the improvement of plant species and cover, which in turn will help reduce this erosion.

| Problems | Suggested treatment |
|---|---|
| **Irrigated lands** | |
| 1. Low yields. | a. Establish higher-yielding forage crops suitable to the soil and water conditions, for hay and pasture.<br>b. Use irrigation methods that will permit more efficient use of water and create an environment for higher producing forage plants.<br>c. Develop a fertilization program.<br>d. Use feed lots when fields are wet. |
| **Nonirrigated lands** | |
| 1. Range condition static or on decline. | a. Practice rotation-deferred grazing.<br>b. Use bottomland pasture to supplement available range.<br>c. Control low economic value plant growth to increase forage production (see photograph 6).<br>d. Develop a program of seeding the rangelands.<br>e. Establish proper use practices.<br>f. Fence to enable better grazing control and proper range use.<br>g. Improve salting and water distribution for better grazing control. |

## Watershed Protection and Erosion Control

The intermingled private range land in the south, as well as the valley upland range land throughout the sub-basin, is generally in poor condition. The sparse cover in this area is conducive to active erosion. The treatment required to reverse the condition trend in this area would include range seeding and spraying of sagebrush on selected sites, along with good management and proper use.

Channel and gully erosion are active throughout the sub-basin. Permanent type control structures and land treatment measures are needed to protect the existing meadows

*Photograph 6. - Rubber rabbitbrush overstory controlled and Great Basin wildrye restored through proper stocking and improved livestock management. (Upper Horseshoe Ranch, Maggie Creek.)* S.C.S. PHOTO--6-382-3

and restore desiccated meadowlands. In addition, bank sloping, seeding of banks, and channel fencing along selected areas will heal erosion.

## Possibilities for Water Salvage

Ground water use by phreatophytic plants was estimated to be about 3,200 acre-feet annually. This includes the water used by Great Basin wildrye and other wet meadow species used for hay and pasture in the valley bottoms. The acreage of alfalfa grown in the valley bottoms is comparatively small and therefore was not included.

Phreatophytic plants such as willows, greasewood, rabbitbrush, wild rose, and saltgrass, which are of low economic value, use an estimated 1,400 acre-feet of water annually. More effort should be made to control or replace these water-consuming plants by spraying, deep drainage, and blading. A large portion of this water could be salvaged by the control or replacement of these water-consuming plants.

# Bureau of Land Management Programs

## National Land Reserve

The Bureau of Land Management is responsible for the administration and management of approximately 48 percent of the Maggie Creek Sub-Basin. Highlights of the Bureau's range management program include the proper use and improvement of the national

land reserve. In addition, the Bureau cooperates with the Nevada Division of Forestry's Northeast Elko Fire Protection District in fire presuppression and control activities on the intermingled public and private lands.

At this time (1963), adjudication of grazing privileges in this sub-basin has been completed on about one-half of the watershed. The range use is practically all in individual or small group allotments. After the allotments are fenced, management plans will be developed for each allotment to insure proper use of the forage resources.

The soil and moisture program is integrated with the grazing program and consists of stabilization and rehabilitation projects necessary to conserve soil, water, and closely related resources. The work also includes improvement of vegetation through natural revegetation, control of undesirable forage plants, the seeding of more desirable plants, as well as soil surveys and hydrological studies on pilot watershed areas. The weed control program is designed to arrest the invasion of new weed species which are poisonous or mechanically injurious to domestic livestock or which threaten the agricultural economy of the area. Another facet of range and watershed management requiring immediate attention is the erosion-proofing or revegetation and retirement of old, abandoned, or low-standard roads, the contributory source of a considerable amount of washing and gullying. It is planned that the construction of all new roads will be done to proper standards and with adequate drainage.

Land classification, fire protection, and recreation are important phases of the Bureau of Land Management program. The long range land program includes the encouragement of land exchanges, in order to establish a more desirable land pattern, particularly on the higher watershed lands. The Bureau's proposed recreation development program is briefly outlined in table 3.

The national land reserve in the Maggie Creek Sub-Basin, along with intermingled private lands, provides some winter range for deer. Deer from the Independence Range migrate into this area during the winter months, while others cross the sub-basin enroute to their winter range in the Union Summit area in the Sulphur Springs Range. The Bureau of Land Management reserves sufficient forage for a reasonable number of big game animals, but a definite deer harvest problem exists on the national land reserve because of limited access to portions of the area.

## Fire Protection

One Federal agency and one State agency are charged with the responsibility for fire prevention and suppression within the sub-basin. The Elko District of the Bureau of Land Management is responsible for the protection from fire on the national land reserve. The State of Nevada, through its Clarke-McNary Northeastern Nevada Fire Protection District, protects the private lands, and assists the Bureau of Land Management with its fire suppression job.

The following factors have helped to keep abreast of the increasing fire risks and hazards:

1. The introduction of new techniques, including more widespread and agressive fire protection.

2. More and better suppression equipment. The agencies concerned have established an air tanker base at Elko, to be used on the suppression of wild fires.

3. The recognition of high hazard areas from the study of past fire occurrence maps and fuel type maps.

4. Use of improved national fire danger rating systems.

5. Improved fire detection and radio communications.

6. Inclusion of cooperator ranch crews in Federal and State fire control organizations.

## WATERSHEDS WITH OPPORTUNITIES FOR PROJECT-TYPE DEVELOPMENT

The Watershed Protection and Flood Prevention Act (Public Law 566, 83d Congress, as amended) authorizes the Secretary of Agriculture to give technical and financial help to local organizations in planning and carrying out works of improvement in watershed or sub-watershed areas of 250,000 acres or less. These projects are for: (1) flood prevention; (2) the agricultural phases of water management; (3) recreation development; and (4) other purposes, such as municipal and industrial water supplies, and improvement for fish and wildlife. Project works of improvement include land treatment measures and individual structures having not more than 5,000 acre-feet of flood-water detention capacity, or not more than 25,000 acre-feet of capacity for all purposes.

Watershed projects provide a means for coordinated scheduling and installation of needed improvements on public and private lands which otherwise would only be accomplished over a longer period of time under other programs.

The problems in the Susie Creek and Maggie Creek watersheds are such that they can best be handled on a project basis. Projects in these watersheds would provide for watershed protection, flood control, reduce erosion, supply late irrigation water and possible recreation development.

A plan for a project watershed on Susie Creek was prepared in 1956, and at the present time is pending further action by the local participants. The proposals in this present report represent an updating of the earlier plan.

### Susie Creek Watershed

Susie Creek enters the Humboldt River about two miles east of Carlin, Nevada. The watershed includes all the drainages tributary to Susie and Dry Susie Creeks north of U. S. Highway 40, which encompasses about 138,500 acres. About 52 percent of the land

is privately owned and 48 percent is national land reserve.

The Independence Mountains and the Adobe Range are the primary source of water for this proposed project watershed. The annual water balance study indicates that the gross water yield for an 80 percent frequency flow is approximately 2,000 acre-feet. From this total an estimated 200 acre-feet are used by irrigated crops and pasture, 800 acre-feet are used by phreatophytes, and 1,000 acre-feet discharge into the Humboldt River.

There are about 200 acres being irrigated in the sub-basin growing native hay and pasture which are used for winter feed for livestock. Treatment measures can be installed and management practices used that will increase yields, decrease erosion, and water use efficiency can be increased.

The predominant plant cover over much of the watershed is big sagebrush-grass. The grasses consist of cheatgrass, Sandberg bluegrass, western wheatgrass, bottlebrush squirreltail, and small amounts of needlegrass. The perennial grasses, bluebunch wheatgrass, Idaho fescue, and Nevada bluegrass which once constituted the plant understory of this site have largely disappeared.

Much of the ryegrass-bluegrass-wheatgrass understory of the former saline bottoms along the larger streams has disappeared through overuse and desiccation from channel cutting. These species have been largely replaced by relatively undesirable rabbitbrush, with small areas of greasewood and saltgrass on the more saline or alkali sites.

At present 64 percent of the range is in a low forage production class, 31 percent in the medium, and five percent in the fairly high forage production class. The proposed treatment measures would increase the acreage in fairly high forage production 11 times. There would be an approximate threefold increase in terms of average pounds of usable forage produced, from the estimated present yield of about 7,400,000 to 21,500,000 pounds.

Flood water, erosion and sediment damage are the primary features of this proposed project. Along with the suggested range and watershed treatment, a combination storage and detention dam across Susie Creek is proposed which would be used for flood control, irrigation, recreation, and sediment storage. The irrigated lands would be in the benefit area. The dam would be located about six and one-quarter miles above the confluence of Susie Creek and the Humboldt River.

A preliminary evaluation of the works of improvement proposed for this watershed is favorable enough to warrant a more detailed study. (For more detailed information see Appendix 1, page 44.)

## Maggie Creek Watershed

The Maggie Creek watershed includes all the drainage tributary to Maggie Creek north of U. S. Highway 40; the area totals about 250,000 acres.

The predominant plant cover over much of the watershed is big sagebrush-grass. Within this type, low sagebrush-grass is found on large claypan bench areas on the south end of the Independence Mountains, lying between Maggie and Susie Creeks.

Large areas of the former Great Basin wildrye-Nevada bluegrass-wheatgrass cover have disappeared from the bottomlands along Maggie Creek and the lower portions of its tributaries, such as Beaver Creek and Symond (Simon) Creek. These species have been generally replaced by relatively undesirable rabbitbrush.

At present, the acreage of range land in the medium and fairly high forage production classes is found primarily on the less accessible middle and upper slopes of the Swales Mountain-Fish Creek Mountain ridge and northward to the western slopes of Lone Mountain. Areas of these forage production classes can also be found on the higher reaches of the intermediate mountain slopes in the Tuscarora Mountains.

The suggested treatment and structural measures would result in better protection for the watershed, reduce erosion, improve the range forage production, protect existing meadows and restore desiccated meadowlands, and reduce management problems. It is estimated that the acreage of rangeland in the fairly high forage production class can be increased more than 11 times. There would be more than twofold increase in the average pounds of usable forage produced in the watershed.

The Tuscarora Mountains produce 83 percent of the gross water yield for this project watershed. The annual water balance study indicated that the gross water yield for an 80 percent frequency flow would be approximately 9,900 acre-feet. From this total an estimated 2,800 acre-feet are used by irrigated crops and pasture, 1,800 acre-feet are used by phreatophytes, and 5,300 acre-feet discharge into the Humboldt River.

Agricultural water management problems which were found to be prevalent include poor seasonal water distribution, high water table in some areas, water supply used to produce low-yielding crops, lack of adequate water control structures, and low water use efficiency.

It is proposed that two earth-fill dams be constructed across Maggie Creek. The reservoir behind the first dam, located at the upper narrows, will store water to irrigate about 1,200 acres of bottomland. This structure would also have some sediment storage and would have some flood control features. The second dam would be located at the lower narrows and would serve for flood control, irrigation storage, and recreation.

It is also proposed that at least three structures be installed in side drainages which will be used to stop silt and other debris from being deposited on the irrigated fields.

For maximum production, the irrigated land would require revised irrigation systems, land smoothing and leveling, drainage, phreatophyte control, controlled diversions, supply ditches, lateral ditches, control structures, and the planting of improved forage crops.

A preliminary evaluation of the works of improvement proposed for this watershed is favorable enough to warrant a more detailed study. (For more detailed information see Appendix 1, page 53.)

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# APPENDIX I

Pertinent elaborative material of value to the general reader, for his reference and guidance in the use of the sub-basin report.

## CONTENTS

# INITIATION OF ACTION
for
# PROJECT-TYPE DEVELOPMENT

## Accomplishing the Improvements, Public Law 566

The development of project operations would need to be initiated by a local sponsoring organization representing the landowners and operators. The sponsoring organization could initiate such action by submitting an application for watershed planning assistance to the Director of the State Department of Conservation and Natural Resources.

Under the provisions of the Watershed Protection Act, and the operations procedures as developed by the U. S. Department of Agriculture, a local sponsoring organization would provide needed land rights for structural improvements, and assume the responsibility for contracting the structural work and for its subsequent operation and maintenance.

The landowners would have responsibility for the installation of land treatment measures on the privately owned lands. Cost-sharing and credit assistance could be made available by the U. S. Department of Agriculture for such work.

The Bureau of Land Management would assume responsibility for the installation of land treatment measures on the Federal lands, which would be accomplished with the usual participation in costs by the range users.

Funds appropriated under the Watershed Protection Act can be made available to defray the cost of construction of the structural improvements for flood and sediment damage prevention, and to share in the cost of structural improvements for irrigation and recreation storage. They can also be made available for installing land treatment measures on the Federal land which are intended primarily for the improvement of vegetal cover (range seeding and brush spraying).

# SUSIE CREEK WATERSHED

## Physical Features of the Watershed

### Location

The Susie Creek watershed is on the east side of the sub-basin. The main drainage flows south from its headwaters at Lone Mountain, approximately 25 miles north of Carlin, Nevada, and enters the Humboldt River two miles east of Carlin. The watershed includes all the drainages tributary to Susie Creek and Dry Susie Creek north of U. S. Highway 40 (Interstate 80).

### Geology

Consolidated sedimentary rocks of Paleozoic age form the basement complex underlying the watershed. They crop out in the surrounding mountains. These rocks consist of shale, chert, limestone, dolomite, sandstone, quartzite, and altered volcanic rock.

Tertiary lava flows and related volcanic rocks were extruded onto deposits of the Humboldt formation and consolidated Paleozoic sediments, and sometimes were interbedded with deposits of the Humboldt formation.

Evidences of low-angle thrust faulting are present on the flanks of Lone Mountain. This thrust is domed by intrusive rocks. A trace of the fault, marked by a thick zone of breccia, occurs along Cold Creek south of Lone Mountain.

North, west, and south of Lone Mountain the foothills are mantled by welded tuff. Acidic and basaltic welded tuff and interbedded volcanic breccia crop out north of Coon Creek. The welded tuff may grade laterally into vitric tuff exposed north and south of Cold Creek and along Camp Creek. The vitric tuff is probably part of the Humboldt formation. Thick accumulations of water-deposited volcanic ash are interbedded with lake sediments along Susie Creek.

### Soils

Recent alluvial soils form the floodplain of Susie Creek. These soils consist of light colored silts with stratified sands and gravels. Wet meadows developed along some sections of the bottomlands have caused the soils to become dark due to high organic contents. These soils are medium to fine textured, well to poorly drained, and have slight to strong salt and alkali concentrations.

Above the valley bottoms the soils are generally shallow to moderately deep, medium or stony and gravelly medium textured, and well to excessively drained. On the terraces a claypan has developed in the subsoil at shallow to moderate depths.

## Vegetation

The predominant plant cover over much of the watershed is big sagebrush-grass. Within this type, low sagebrush-grass is found on large claypan bench sites lying on the northwest slopes of the Adobe Range, at the head of Middle Susie Creek. The low sage-grass vegetal association is also found along the Swales Mountain ridge (Independence Range) west of Susie Creek. This type is usually interlaced with big sagebrush-grass in the depressions and on the deeper soils.

Through lack of proper management and the desiccation resulting from severe channel cutting, much of the Great Basin wildrye-Nevada bluegrass-wheatgrass cover has disappeared from the saline bottomlands along Susie Creek and its principal tributaries, such as Cold Creek, Singletree Creek, Blue Basin and Swales Creeks. These species have been generally replaced by relatively undesirable rabbitbrush, with small areas of greasewood and saltgrass on the more saline or alkali-laden sites at the lower end of Susie Creek.

The perennial grasses - bluebunch wheatgrass, Idaho fescue, and Nevada bluegrass - which once constituted the bulk of the sagebrush-grass and mixed browse-grass understory have largely disappeared over much of the watershed. These desirable forage species are now found in significant quantities only on protected, remote, or inaccessible relict areas. Through grazing overuse, primarily by domestic livestock, most of the perennial grass understory has been replaced by cheatgrass and such increaser (less desirable) species as big sagebrush, Sandberg bluegrass, bottlebrush squirreltail, and small amounts of needlegrass.

## Climate

The average annual precipitation for the watershed varies from seven inches at Carlin, 20 inches in the Independence Mountains and 12 inches in the Adobe Range. On the cropland the precipitation is eight to 10 inches.

## Land Status and Use

There are approximately 13 private land owners in the sub-basin. The range land is used primarily for spring-fall and summer grazing of domestic livestock and big game, and as a year-long habitat for other wildlife. These lands are also important as watershed areas.

A small acreage of bottomland (200 acres) is irrigated to produce hay and pasture for the winter feeding of cattle grazing on the intermingled private and Federal lands.

The land status and use breakdown is as shown below:

| Land Status | Acres | Land use | | | | | |
|---|---|---|---|---|---|---|---|
| | | Range land | | Irrigated land | | Barren or inaccessible | |
| | | Acres | % | Acres | % | Acres | % |
| National Land Reserve | 66,200 | 65,900 | 48 | --- | --- | 300 | 60 |
| Private | 72,300 | 71,900 | 52 | 200 | 100 | 200 | 40 |
| Total | 138,500 | 137,800 | 100 | 200 | 100 | 500 | 100 |

## Water Supply and Use

### Surface Water

The Independence Mountains and the Adobe Range are the primary source of water for this project watershed. Runoff from snowmelt furnishes most of the water. Numerous springs supply water for livestock and wildlife use. Although an adequate annual water supply exists, under present use it is poorly distributed as to seasonal flow and as to location within the watershed. Swales Creek and Camp Creek draining the Independence Mountains and Adobe Creek draining the Adobe Range normally are continuous flow streams, supplying water for livestock and irrigation. The annual water balance study indicates that the gross water yield for an 80 percent frequency flow would be approximately 2,000 acre-feet. From this total an estimated 200 acre-feet are used by irrigated crops and pasture, 800 acre-feet are used by phreatophytes and 1,000 acre-feet discharge into the Humboldt River.

### Ground Water

Ground water sources are more likely to occur in the deeper aquifers found in the Tertiary alluvial and lake deposits. The more satisfactory irrigation wells would probably be located in the relatively flat broad valley bottomlands, principally in the lower end of the drainages and near the Humboldt River.

Ground water development at present consists of a few low capacity wells used for stockwater and farmstead use. There have been no known ground water investigations made except on an individual site basis.

### Water Needs for Recreation Areas and Special Use Sites

At present there are no developed recreation areas or special use sites in the watershed. The Bureau of Land Management plans to develop hunter-fisherman camps in Blue Basin and on Swales Mountain. These developments will cover one acre each and will require only a fraction of an acre-foot of water.

## Watershed Problems

### Agricultural Water Management

Generally by the end of May the irrigation water is depleted, except for small

flows from springs. During the period of runoff most of the native hay and pasture lands are continuously irrigated. These conditions are conducive to the low-yielding crops grown in the area.

Water is spread over the lands and diverted into ditches by obstructions in the stream channel. These uncontrolled diversions make water management difficult. There have been few significant surface irrigation developments in the watershed.

Agricultural water management problems which were found to be prevalent include:

1. Poor seasonal water distribution.
2. High water table in some areas.
3. Water supply used to produce low-yielding crops.
4. Lack of adequate water control structures.
5. Low water use efficiency.

Flood Water, Erosion and Sediment Damage

Each of the wet-mantle flood periods subsequent to the system-wide Humboldt floods of March - June 1890 contributed to channel cutting, sedimentation, extensive flooding and livestock losses on the bottomlands along Susie, Camp, Swales, Blue Basin, and Cold Creeks. Of particular note were the wet-mantle floods of 1890, 1910, 1914, 1943, 1952, and 1962, and the dry-mantle flood periods of 1874, 1941, and 1961.

Vegetation - Kind and Condition

Phreatophytes

In the proposed watershed area, through overuse and lack of proper management and the resultant meadow desiccation by deep gullying, much of the ryegrass-bluegrass-wheatgrass cover of the former meadows along most of Susie Creek and its tributaries has disappeared (see photograph 7). The only area where any considerable amount of this

*Photograph 7. - Deeply incised channel, upper Susie Creek, which has desiccated the former meadow, now replaced by rubber rabbitbrush and sagebrush.* S.C.S. PHOTO--6-182-5

original cover may be found is in a few scattered meadows along Cold Creek, between the Hunter-Banks cabin and the Sproule cabin, about five miles upstream. Even this meadow area is being threatened by the gully encroaching up lower Cold Creek. (See table 4.)

### Range Forage Production

Table 5 furnishes information on the range forage production acreage, present and potential, for the Susie Creek watershed. At present, the range acreage in the medium and fairly high forage production classes is found primarily on the less accessible middle and upper slopes of the Swales Mountain ridge and northward to the southern slopes of Lone Mountain. A considerable acreage of medium production class range is located on the low sage-grass site and the intermediate mountain slopes in the higher reaches of the Adobes, at the heads of Dry Susie and Middle Susie Creeks. Most of these areas of better forage production are on the national land reserve toward the north end of the watershed. Practically all of the former meadows along the stream bottoms are in the low forage production class, being badly depleted and desiccated by the gullies which have developed along almost every stream channel.

## Opportunities for Development

### Agricultural Water Management

#### Land Treatment Measures

There are an estimated 285 acres of land with water rights. Approximately 200 are presently being used as cropland or pasture. Most of this land can be made to produce better forage crops with greater yields by reorganizing the irrigation systems, installing drainage on some fields, planting improved forage crops, and using improved water management practices. There would be no stored water available for these lands.

### Flood Control

It is proposed that an earth-fill dam be constructed across Susie Creek about six and one-quarter miles above its confluence with the Humboldt River. A dam 50 feet high and 500 feet long would require an estimated 135,000 cubic yards of fill and would have an estimated capacity of 6,500 acre-feet. It may be possible to construct a spillway with a rock foundation in the right abutment.

The reservoir behind this dam would be used for flood control, irrigation, sediment storage, and recreation development. There are no irrigated lands below the dam site within the boundary of the watershed. There are irrigated lands around Carlin which could benefit from this proposed water storage.

### Watershed Protection and Improvement

Watershed deterioration and the accompanying reduction in range forage production has not only damaged the watershed's hydrologic characteristics, but has also

Table 4. -- Phreatophyte acreage and annual ground water use, Susie Creek watershed 1/

| Species | Height class | Density | Acreage cropland | Acreage range types 2/ | Annual ground water use 2/ (feet) | Annual ground water use 2/ (acre-feet) |
|---|---|---|---|---|---|---|
| Willow | 8-12' | .2-.3 | ----- | 30 | 2.2 | 70 |
| Rose | 3-8' | .2-.3 | ----- | 10 | 1.5 | 20 |
| Black greasewood | 3'+ | .04 | ----- | 20 | .3 | 10 |
| Rubber rabbitbrush | 3'+ | .06-.08 | ----- | 980 | .3 | 300 |
| Saltgrass | ---- | .04-.25 | ----- | 120 | .5 | 60 |
| Great Basin wildrye | ---- | .04-.3 | ----- | 340 | 1.0 | 340 |
| Subtotal | | | | 1,500 | | 800 |
| Wet meadow 3/ | ---- | ------ | 200 | | .5 | 100 |
| Subtotal | | | 200 | | | 100 |
| Total | | | 200 | 1,500 | | 900 |

1/ These values when referred to in the text are rounded.
2/ These values are based on natural stand densities and 100 percent composition, for each species, except for the irrigated and wet meadows.
3/ Mixture of Great Basin wildrye, creeping wildrye, sedges, and other grasses.

Source: Humboldt River Basin Field Party.

Table 5. -- Acreage classes of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Susie Creek watershed

| Vegetal type and site | Present annual forage pland production classes (acres) | | | Potential annual forage plant production classes (acres) | | | Treatment needed to reach potential |
|---|---|---|---|---|---|---|---|
| 1. Rabbitbrush-greasewood-grass; saline bottomlands | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 850-1,500 | 200-900 | 20-300 | 850-1,500 | 200-900 | 20-300 | |
| A14-A13 | ----- | --- | 4,260 | 3,000 | 1,000 | 260 | Brush removal, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| A14-H2 | ----- | 100 | 3,910 | 3,000 | 900 | 110 | |
| Subtotal | ----- | 100 | 8,170 | 6,000 | 1,900 | 370 | |
| 2. Big sagebrush-grass; upland benches and terraces | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 250-600 | 100-450 | 20-150 | 250-600 | 100-450 | 20- 150 | |
| B1-R1-L4 | ----- | ----- | 2,300 | 1,000 | 300 | 1,000 | Brush removal and seeding, selective spraying, fencing, stockwater development, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| B10-R1-L4 | ----- | 400 | 15,100 | 9,000 | 5,500 | 1,000 | |
| B11-C2-S3-L3 | ----- | 1,500 | 3,600 | 3,600 | 1,000 | 500 | |
| L12-B3-C1 | ----- | 2,060 | 13,400 | 8,800 | 5,660 | 1,000 | |
| S3-S4-B10-T1 | 2,000 | 5,900 | 27,600 | 18,500 | 16,000 | 1,000 | |
| S10-S3-B11 | ----- | 1,170 | ------ | 1,000 | 170 | ----- | |
| Subtotal | 2,000 | 11,030 | 62,000 | 41,900 | 28,630 | 4,500 | |
| 3. Low sagebrush-grass; claypan bench | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 200-500 | 100-250 | 50-150 | 200-500 | 100-250 | 50-150 | |
| B10-B11-B3 | ----- | 600 | 900 | 600 | 800 | 100 | Selective spraying, fencing, stockwater development, erosion-proofing of roads, proper management and stocking. |
| C4-B10-L1 | 4,000 | 3,000 | 1,000 | 7,000 | 800 | 200 | |
| L12-B3-C1 | ----- | 15,200 | 500 | 12,000 | 3,400 | 300 | |
| S3-S4-B10-T1 | ----- | 1,200 | ----- | 1,100 | 100 | --- | |
| Subtotal | 4,000 | 20,000 | 2,400 | 20,700 | 5,100 | 600 | |

Continued

Table 5. -- Acreage classes of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Susie Creek watershed -- Continued

| Vegetal type and site | Present annual forage plant production classes (acres) | | | Potential annual forage plant production classes (acres) | | | Treatment needed to reach potential |
|---|---|---|---|---|---|---|---|
| 4. Browse-aspen-grass; intermediate mountain slopes | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 300-650 | 150-350 | 50-200 | 300-650 | 150-350 | 50-200 | |
| C4-B10-L1 | 1,000 | 3,800 | 13,600 | 10,900 | 6,000 | 1,500 | Selective spraying, fencing, stockwater development, erosion-proofing of roads, proper management and stocking. |
| C4-B10-L11 | ----- | 4,700 | 1,500 | 3,000 | 2,700 | 500 | |
| L12-B3-C1 | ----- | ----- | 300 | ------ | 300 | ----- | |
| Subtotal 2/ | 1,000 | 8,500 | 15,400 | 13,900 | 9,000 | 2,000 | |
| 5. Pinyon-juniper-grass; shallow stony slopes | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 100-250 | 50-150 | 10-75 | 100-250 | 50-150 | 10-75 | |
| C4-B10-L11 | ----- | 1,000 | --- | 800 | 200 | --- | Fencing, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| S3-S4-B10-T1 | ----- | 1,500 | 700 | 1,000 | 700 | 500 | |
| Subtotal | ----- | 2,500 | 700 | 1,800 | 900 | 500 | |
| Total | 7,000 | 42,130 | 88,670 | 84,300 | 45,530 | 7,970 | |

1/ These figures indicate total annual forage production (dry weight), and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the administrative agency.

These rates represent production variance from poor years to good years. At higher elevations within the site, with greater precipitation the rates would be higher, and conversely for lower elevations.

2/ Does not include 500 acres of barren or inaccessible.

Source: Humboldt River Basin Field Party.

imperiled the livestock industry itself. The following measures are considered to be the minium treatment necessary to promote watershed protection and improve the range to the potential indicated in table 5:

1. Install channel and streambank stabilization on approximately 30 miles of channel, and do the fencing necessary to protect this stabilization work. This treatment is needed along almost the full length of Susie Creek and most of its tributaries, particularly those on the west side of the watershed.

2. Install gully control structures at selected sites on the heads of drainages.

3. Treat all roads contemplated, in use, or abandoned, to prevent or stop erosion. At least 20 miles of this treatment are needed on existing roads.

4. Vegetal improvement by sagebrush control and range seeding on selected sites covering an estimated 6,000 acres of upland bench and terrace, and claypan bench, which at present are in the low forage production class.

5. Brush overstory removal by blading on about 7,000 acres of saline bottomlands.

6. Control sagebrush to thicken the grass understory by selective spraying on about 17,000 acres.

7. Construct approximately eight miles of allotment and management fences (see photograph 8).

8. Develop approximately 30 springs and seeps, wells and ponds for stockwater, to improve livestock distribution and forage utilization.

9. Keep the rabbit and small rodent population at a minimal figure, avoiding the high population peaks so destructive to forage.

10. Adjust livestock numbers and seasons of use to an indicated safe carrying capacity where needed; follow proper management practices. Complete the allotment adjudication program on the national land reserve.

11. Maintain big game numbers in balance with their food supply.

*Photograph 8. - An illustration of the effects of fencing and proper livestock management on vegetal cover, Susie Creek bottom above the upper narrows, looking south. The willow stringers and thickened perennial vegetal cover in the fenced area beyond the road and bridge have materially reduced channel cutting. Contrast this with the unfenced, overused area in the foreground, with its thin vegetal cover and incipient channel cutting.* S.C.S. PHOTO--F-32-1

## Benefits Expected

### Agricultural Water Management

The cropland can produce greater yields with less erosion, and better water use efficiency can be attained after the installation of the proposed treatment measures. In addition there would be an opportunity to accumulate water for the irrigated lands with water rights outside the watershed area.

### Flood Control

The proposed flood control dam would offer protection to U. S. Highway 40, the Southern Pacific and Western Pacific railroads, pasture land along the Humboldt River, and to a limited extent the town of Carlin, Nevada.

In addition this detention reservoir would provide storage for an estimated 25 or 30 acre-feet of sediment which Susie Creek contributes annually to the Humboldt River, and would provide an opportunity for recreation development.

### Watershed Protection and Improvement

The treatment and structural measures would result in better protection for the watershed, reduce erosion, improve the range forage production, protect existing meadows and restore desiccated meadowlands, and reduce management problems. These

benefits are reflected in terms of potential range forage improvement in table 5. It is estimated that the acreage of range land in the fairly high forage production class can be increased 11 times. There would be an approximate threefold increase in terms of average pounds of usable forage produced, from the estimated present yield of approximately 7,400,000 pounds to 21,500,000 pounds.

## Conclusion

A preliminary evaluation of the proposed works of improvement is favorable enough to warrant a more detailed study.

# MAGGIE CREEK WATERSHED

## Physical Features of the Watershed

### Location

The Maggie Creek watershed is on the west side of the sub-basin. It includes the drainages tributary to Maggie Creek above U. S. Highway 40 (Interstate 80).

### Geology

Consolidated sedimentary rocks of Paleozoic age form the basement complex underlying the watershed. They crop out in the mountains throughout the area. These rocks include shale, chert, calcareous shale, shaly limestone, massive to platy limestone, dolomitic limestone, dolomite, sandstone, quartzite, and altered volcanic rock.

Partially consolidated alluvial and lake sediments and interbedded volcanic rocks underlie the uplands and lowlands. They lie unconformably on consolidated Paleozoic sediments, and include conglomerate, sandstone, shale, limestone, diatomite and volcanic tuff, breccia, and lava. Beneath the lowlands these deposits are overlain by Quaternary alluvium.

Acidic and basaltic welded tuff and interbedded volcanic breccia crop out north of Coon Creek, northwest of Lone Mountain.

### Soils

The soils of the watershed are mostly deep to moderately deep, medium or stony and gravelly medium textured, and well to excessively drained. There are some bottomland soils which are moderately fine to fine textured, imperfect to poorly drained, and which have slight to strong salt and alkali concentrations. The mountain highlands and valley uplands have some soils that are shallow over bedrock and some that are moderately deep over a hardpan.

### Vegetation

The predominant plant cover over much of the watershed is big sagebrush-grass. Within this type, low sagebrush-grass is found on large claypan bench areas on the south end of the Independence Mountains, lying between Maggie and Susie Creeks. Claypan bench sites are also located on the benchlands west of Maggie Creek, in the northwest portion of the watershed. Extensive areas of black sage (A. nova)-grass are found on the shallow soils of the mountain slopes and tops from 6,500 to over 8,000 feet, within the intermediate mountain slopes site in the Tuscarora Range, west of Maggie Creek.

Large areas of the former Great Basin wildrye-Nevada bluegrass-wheatgrass cover have disappeared from the bottomlands along Maggie Creek and the lower portions of its tributaries, such as Beaver Creek and Symond (Simon) Creek. Through lack of proper

management and the desiccation resulting from severe channel cutting, the species have been generally replaced by relatively undesirable rabbitbrush. Small areas of saltgrass are found on the more saline or alkali-laden sites at the lower end of Maggie Creek.

The perennial grasses - bluebunch wheatgrass, Idaho fescue, and Nevada bluegrass - which once constituted the bulk of the sagebrush-grass and mixed browse-grass understory have largely disappeared over much of the watershed. These desirable forage species are now found in significant quantities only on protected, remote, or inaccessible relict areas. Through grazing overuse, primarily by domestic livestock, most of the perennial grass understory has been replaced by cheatgrass and such increaser (less desirable) species as big sagebrush, Sandberg bluegrass, bottlebrush squirreltail, and small amounts of needlegrass.

It should be noted, however, that through improved management and stocking practices, many portions of the privately owned range in the middle portions of the Maggie Creek watershed are showing a marked improvement in vegetal cover and composition. (See photograph 6.)

## Climate

There are no precipitation or temperature gaging stations in the watershed. Records from stations adjacent to this area, and the water balance studies, indicate the average annual precipitation would vary between seven inches around Carlin to 25 inches (8,000 to 9,000 feet) in the Tuscarora Mountains. Most of the moisture falls in the form of snow during the winter months.

The growing season for the irrigated lands (28 degrees F) is estimated to vary between 120 days in the south end of the watershed and 90 days at the higher elevations.

## Land Status and Use

The land status and use breakdown is as shown below:

| Land Status | Acres | Land use | | | | | |
|---|---|---|---|---|---|---|---|
| | | Range land | | Irrigated land | | Barren or inaccessible | |
| | | Acres | % | Acres | % | Acres | % |
| National Land Reserve | 121,800 | 120,200 | 49 | ----- | --- | 1,600 | 44 |
| Private | 128,200 | 123,100 | 51 | 3,100 | 100 | 2,000 | 56 |
| Total | 250,000 | 243,300 | 100 | 3,100 | 100 | 3,600 | 100 |

The private land is divided among an estimated 25 land owners. The 3,100 acres of irrigated land are used to produce hay and pasture for the winter feeding of cattle grazing on the intermingled private and Federal rangeland.

The Federal and private range lands are used for spring-fall and summer range for

domestic livestock and big game, as year-long range for other wildlife, and as a watershed area.

## Water Supply and Use

### Surface Water

The Tuscarora Mountains are the primary source of water for this project watershed, contributing 83 percent of its gross water yield. Runoff from snowmelt furnishes most of the irrigation water.

The annual water balance study indicates that the gross water yield for an 80 percent frequency flow year would be approximately 9,900 acre-feet. From this total an estimated 2,800 acre-feet are used by irrigated crops and pasture, 1,800 acre-feet are used by phreatophytes, and 5,300 acre-feet discharge into the Humboldt River. In addition there are an unknown number of stock water developments (ponds, springs, and wells) which use some water.

### Ground Water

At the present time there is one water well developed for irrigation. This well has an estimated capacity of 3,000 g.p.m.; it is presently producing 2,000 g.p.m. In addition there are a few low capacity wells for stock water and for farmstead use. There have been no known ground water investigations made except on an individual site basis.

Ground water sources are more likely to occur in the deeper aquifers found in the Tertiary alluvial and lake deposits. The more satisfactory irrigation wells would probably be located in the relatively flat broad valley bottomlands, principally in the lower end of the drainages and near the Humboldt River. Geological investigation, test drilling to determine aquifer characteristics and quality of water, and modern methods of well construction are necessary to obtain satisfactory wells.

### Water Needs for Recreation Areas and Special Use Sites

At present there are no developed recreation areas or special use sites in the watershed. The Bureau of Land Management plans to develop two sites; the Rip Van Winkle Mine camp site, and the Big Six (Lynn) camp and gold panning site. Each of the camps will cover one acre when developed and will require only a fraction of an acre-foot of water.

## Watershed Problems

### Agricultural Water Management

Generally by the end of June the irrigation water supply is depleted, with the peak runoff periods occurring in April and May. During the period of runoff the native hay and pasture lands are being continuously irrigated. There are no storage reservoirs in

the area; these conditions are conducive to the low-yielding crops grown.

Water is spread over the lands and diverted into ditches by obstructions in the river channel (see photograph 2). These uncontrolled diversions make it difficult to manage the water. The general practice is to have at least one diversion for each field.

There have been few significant surface irrigation developments in the watershed. One ranch in the lower end of the drainage has developed 138 acres of cropland, with an irrigation system which will permit efficient water use.

Agricultural water management problems which were found to be prevalent include:

1. Poor seasonal water distribution.
2. High water table.
3. Water supply used to produce low-yielding crops.
4. Lack of adequate water control structures.
5. Low water use efficiency.

## Flood Water, Erosion and Sediment Damage

Each of the wet-mantle flood periods subsequent to the system-wide Humboldt floods of March - June 1890 contributed to channel cutting, sedimentation, extensive flooding and livestock losses on the bottomlands along Maggie Creek and its principal tributaries. Of particular note were the wet-mantle floods of 1890, 1910, 1914, 1922, 1943, 1952, and 1962 (see photograph 9).

*Photograph 9. - Bridge over lower Lynn (Symond, Simon) Creek, immediately above its junction with Maggie Creek, damaged by the February 9-13, 1962 wet-mantle flood.*

SCS PHOTO--F-389-11

For most of the Humboldt Basin, the spring of 1922 was not classfied as a wet-mantle flood year, with the possible exception of the Little Humboldt Sub-Basin, where semi-flood conditions did develop. Along the major portion of the Humboldt River system, dry, unfrozen soil underlying the heavy snow-pack accumulated during the winter of 1921-1922 absorbed the major portion of the snowmelt in the spring of 1922, preventing extensive flooding. However, on Maggie Creek, as along the Little Humboldt, flood or semi-flood conditions did develop, as the highest discharge previously known there, prior to the 1962 wet-mantle flood, occurred on May 7, 1922.

The dry-mantle flood periods of 1874, 1941, and 1961 were the only such floods in the watershed which have produced damage from this type of storm.

## Vegetation - Kind and Condition

### Phreatophytes

In the proposed watershed area, through lack of proper management and the resultant meadow desiccation by deep gullying, much of the ryegrass-bluegrass-wheatgrass cover of the former meadows along Maggie Creek and its tributaries has disappeared (see photograph 10). The only areas where any considerable amount of the original cover may be found are on the improved hay lands above the upper and lower Maggie Creek narrows. (See table 6.)

*Photograph 10. - Eroding stream channel, approximately 15 feet deep, which is draining the adjacent willow-meadow type. Note the dead willows on the left bank, and the invading rubber rabbitbrush on the right bank. Coon Creek, four miles west of Lone Mountain, looking west.*

FIELD PARTY PHOTO--6-792-4

Table 6. -- Phreatophyte acreage and annual ground water use, Maggie Creek watershed 1/

| Species | Height class | Density | Acreage cropland | Acreage range types 2/ | Annual ground water use 2/ (feet) | Annual ground water use 2/ (acre-feet) |
|---|---|---|---|---|---|---|
| Willow | 8-12' | .2-.3 | ----- | 210 | 2.2 | 460 |
| Rose | 3-8' | .2-.3 | ----- | 80 | 1.5 | 120 |
| Rubber rabbitbrush | 3'+ | .04-.08 | ----- | 1,260 | .3 | 370 |
| Great Basin wildrye | ---- | .06-.15 | ----- | 850 | 1.0 | 850 |
| Subtotal | | | | 2,400 | | 1,800 |
| Irrigated meadow hay and pasture 3/ | | | 700 | | .3 | 200 |
| Wet meadow 3/ | | | 600 | | .5 | 300 |
| Subtotal | | | 1,300 | | | 500 |
| Total | | | 1,300 | 2,400 | | 2,300 |

1/ These values when referred to in the text are rounded.
2/ These values are based on natural stand densities and 100 percent composition, for each species, except for the irrigated and wet meadows.
3/ Mixture of Great Basin wildrye, creeping wildrye, sedges, and other grasses.

Source: Humboldt River Basin Field Party.

### Range Forage Production

Table 7 furnishes information on the range forage production acreage, present and potential, for the Maggie Creek watershed. At present, the acreage in the medium and fairly high forage production classes is found primarily on the less accessible middle and upper slopes of the Swales Mountain - Fish Creek Mountain ridge and northward to the western slopes of Lone Mountain. A considerable acreage of medium forage production range, and some acreages of fairly high forage production, are located on the intermediate mountain slopes in the higher reaches of the Tuscarora Mountains, along the west side of the watershed. A major portion of these acreages of better forage production is on the national land reserve, along the west and north sides of the watershed. Practically all the former meadows along the stream bottoms are in the low forage production class, being depleted and desiccated by the gullies which have developed in almost every stream bottom.

## Opportunities for Development

## Agricultural Water Management

### Structural Measures

It is proposed that an earth fill dam be constructed across Maggie Creek at the upper narrows, about 25 miles by road north of U. S. Highway 40. A dam 50 feet high and about 400 feet long at its crest would require an estimated 93,000 cubic yards of fill. A moderately deep cutoff trench is included in this estimate.

The reservoir behind this dam would hold about 4,000 acre-feet of water. This storage area would be large enough for irrigation requirements of the estimated 1,200 acres of land with water rights on Maggie Creek below the dam, plus sediment storage and some flood control. The height of the dam could be increased if additional flood control protection and storage for recreation development were desired.

It would be necessary to clear the Maggie Creek channel below the dam of all obstructions so that water in excess of water rights stored in the reservoir could flow freely down stream.

In addition it will be necessary to construct debris basins on the side drainages above and below this reservoir site. It will require at least three of these structures to adequately protect the irrigated fields.

### Land Treatment Measures

There are an estimated 3,500 acres of land with either "A", "B", or "C" water rights in the watershed. About 1,200 acres could be irrigated from the proposed storage reservoir. For maximum production, most of the irrigated land would require revised irrigation systems; 2,000 acres of land smoothing or leveling; 200 acres of drainage; 4,500 acres of phreatophyte control; 30 miles of supply ditches; nine diversions; the necessary

Table 7. -- Acreage classes of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Maggie Creek watershed

| Vegetal type and site | Present annual forage plant production classes (acres) | | | Potential annual forage plant production classes (acres) | | | Treatment needed to reach potential |
|---|---|---|---|---|---|---|---|
| 1. Rabbitbrush-greasewood-grass; saline bottomlands | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 850-1,500 | 200-900 | 20-300 | 850-1,500 | 200-900 | 20-300 | |
| A14-A13 | ----- | ----- | 3,150 | 2,050 | 1,000 | 100 | Brush removal, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| H2-H4 | ----- | ----- | 9,850 | 6,000 | 3,350 | 500 | |
| Subtotal | ----- | ----- | 13,000 | 8,050 | 4,350 | 600 | |
| 2. Big sagebrush-grass; upland benches and terraces | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 250-600 | 100-450 | 20-150 | 250-600 | 100-450 | 20-150 | |
| B10-B11-B3-C2 | 400 | 16,400 | 43,300 | 36,600 | 22,000 | 1,500 | Brush removal and seeding, selective spraying, stockwater development, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| C4-B10-L1 | --- | 8,800 | ------ | 6,000 | 2,800 | ----- | |
| C4-B10-L10 | --- | 1,000 | ------ | 800 | 200 | ----- | |
| S3-S4-B10-T1 | 200 | 4,700 | 22,900 | 15,800 | 10,000 | 2,000 | |
| S11-B2-Y2 | --- | ----- | 10,900 | 3,500 | 6,000 | 1,400 | |
| Subtotal 2/ | 600 | 30,900 | 77,100 | 62,700 | 41,000 | 4,900 | |
| 3. Low sagebrush-grass; claypan bench | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 200-500 | 100-250 | 50-150 | 200-500 | 100-250 | 50-150 | |
| B10-B11-B3-C2 | ----- | 4,500 | 3,400 | 4,000 | 3,000 | 900 | Brush removal and seeding, selective spraying, stockwater development, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| C4-B10-L1 | 3,900 | 11,800 | 2,300 | 11,000 | 6,000 | 1,000 | |
| C4-B10-L10 | ----- | 8,500 | ----- | 6,500 | 2,000 | ----- | |
| S3-S4-B10-T1 | ----- | ------ | 400 | 100 | 300 | ----- | |
| Subtotal 3/ | 3,900 | 24,800 | 6,100 | 21,600 | 11,300 | 1,900 | |

Continued

Table 7. -- Acreage classes of present and potential annual forage plant production classes, grouped by soil associations for each vegetal type and site, Maggie Creek watershed -- Continued

| Vegetal type and site | Present annual forage plant production classes (acres) | | | Potential annual forage plant production classes (acres) | | | Treatment needed to reach potential |
|---|---|---|---|---|---|---|---|
| 4. Browse-aspen-grass; intermediate mountain slopes | Production classes (pounds per acre) 1/ | | | Production classes (pounds per acre) 1/ | | | |
| Soil associations | 300-650 | 150-350 | 50-200 | 300-650 | 150-350 | 50-200 | |
| B1-L1-B4-C4 | ----- | 4,900 | 1,200 | 3,500 | 2,100 | 500 | Brush removal and seeding, selective spraying, stockwater development, erosion-proofing of roads, streambank and channel stabilization, proper management and stocking. |
| C4-B10-L1 | 1,100 | 19,900 | 11,800 | 20,000 | 11,800 | 1,000 | |
| C4-B10-L10 | 3,800 | 3,400 | ------ | 6,000 | 1,200 | ----- | |
| R12-L10-C1 | 3,000 | 35,000 | 4,100 | 30,000 | 11,600 | 500 | |
| Subtotal 4/ | 7,900 | 63,200 | 17,100 | 59,500 | 26,700 | 2,000 | |
| Total | 12,400 | 118,900 | 113,300 | 151,850 | 83,350 | 9,400 | |

1/ These figures indicate total annual forage production (dry weight), and will be used as a basis for planning needs only. Forage production figures will not be used for assigning range carrying capacities. These carrying capacities will depend upon such factors as slope, soil depth, soil character and stability, and the management objectives of the administrative agency.

These rates represent production variance from poor years to good years. At higher elevations within the site, with greater precipitation the rates would be higher, and conversely for lower elevations.

2/ Does not include 1,200 acres of barren or inaccessible.

3/ Does not include 300 acres of barren or inaccessible.

4/ Does not include 2,100 acres of barren or inaccessible.

Source: Humboldt River Basin Field Party.

lateral ditches, headgates, drops, turnouts, etc.; and the planting of improved forage crops.

Flood Control

It is proposed that an earth-fill dam be constructed across Maggie Creek at the lower narrows about 10 miles by road north of U. S. Highway 40. The purpose of this structure would be for flood control and recreation development, with possible accumulated irrigation storage for water right acreage below the reservoir outside the watershed boundary.

A dam 50 feet high and about 900 feet long at its crest would require about 166,000 cubic yards of fill. The reservoir would have an estimated capacity of 5,000 acre-feet. The height of the dam could be raised if an increase in capacity is necessary.

Watershed Protection and Improvement

The following measures are considered to be the minimum treatment necessary to promote watershed protection and improve the range to the potential indicated in table 7:

1. Install channel and streambank stabilization along approximately 40 miles of channel on Maggie Creek and its tributaries and do the fencing necessary to protect this stabilization work.

2. Install gully control structures at selected sites on the drainage heads.

3. Treat all roads contemplated, in use, or abandoned, to prevent or stop erosion. Treatment is needed on at least 20 miles of such roads.

4. Vegetal improvement by sagebrush control and range seeding on selected sites covering an estimated 1,000 acres of claypan bench-low sagebrush grass which at present are in the low forage production class.

5. Brush overstory removal by blading on about 9,000 acres of saline bottomlands.

6. Control sagebrush to thicken the present grass understory by selective spraying on about 45,000 acres.

7. Develop approximately 30 springs and seeps, wells and ponds for stockwater, to improve livestock distribution and forage utilization.

8. Keep the rabbit and small rodent population at a minimal figure, avoiding the high population peaks so destructive to forage.

9. Adjust livestock numbers and seasons of use to an indicated safe carrying capacity where needed; follow proper management practices. Complete the allotment adjudication program on the national land reserve lands.

10. Maintain big game numbers in balance with their food supply.

## Benefits Expected

### Agricultural Water Management

The proposed reservoir would provide a full-season irrigation water supply for about 1,200 acres of hay and pasture land. In addition, it would provide for sediment storage; some flood protection; allow the development of a more stable irrigation cropping program; permit a higher quality hay to be grown; be conducive to obtaining greater forage yields; reduce the acreage needed for hay production; and make higher irrigation efficiency possible. Also, it would be possible to include some storage for recreation development if desired.

The cropland not under the proposed reservoir could produce greater yields with less erosion and water loss after the installation of the proposed treatment measures.

### Flood Prevention and Sediment Damage Control

The proposed dam and reservoir would provide flood protection for irrigated lands; U. S. Highway 40 (eventual Interstate 80); two railroads, Southern Pacific and Western Pacific; the Southern Pacific yards, and facilities east of Carlin; and the town of Carlin. In addition it would provide for recreation development, sediment storage, and possibly irrigation water storage for a small acreage.

Debris basins on selected side channels would control sediment which at present is encroaching on the irrigated fields.

### Watershed Protection and Improvement

The treatment and structural measures would result in better protection for the watershed, reduce erosion, improve the range forage production, protect existing meadows, restore desiccated meadowlands, and reduce management problems. These benefits are reflected in terms of potential range forage improvement in table 7. It is estimated that the acreage of range land in the fairly high forage production class can be increased over 11 times. There would be over a twofold increase in terms of average pounds of usable forage produced, from the estimated present yield of 16,500,000 pounds to 38,500,000 pounds.

## Conclusion

A preliminary evaluation of the proposed works of improvement is favorable enough to warrant a more detailed study.

## SOILS DESCRIPTION

The generalized soil survey of the Maggie Creek Sub-Basin shows the location and distribution of different kinds of soils by associations of Great Soil Groups. Each Great Soil Group includes a number of soils with similar internal characteristics that reflect the environmental conditions responsible for their development. Great Soil Groups mapped in the survey include:

### Alluvial Soils (Symbol: A)

These are the soils that consist of essentially recent stream-laid deposits: alluvial fans, floodplains, terraces and basins. They have essentially no profile development, but a little organic matter may have accumulated. They are usually deep, stratified, variable with regard to drainage class, and occur under many different climatic conditions.

### Brown Soils (Symbol: B)

These are the soils which have dark brownish A horizons about six inches thick, textural B horizons 10 to 15 inches thick, and calcareous parent material of variable thickness. Some of these soils have cemented calcium carbonate layers in the C horizon and some may have the C horizon resting on bedrock. They are usually moderately deep to deep, well drained, and occur under a cool semi-arid climate with an average precipitation of seven to 20 inches. Most of the Brown Soils in the Maggie Creek Sub-Basin occur at elevations above 5,000 feet, in the uplands.

### Chestnut Soils (Symbol: C)

These soils have dark grayish brown to very dark grayish brown A horizons about six to eight inches thick, textural B horizons 10 to 15 inches thick, and parent material that may or may not be calcareous. These soils usually have darker A horizons, more organic matter, and have been more strongly leached than have the Brown Soils. The parent material may or may not rest on bedrock. They are usually moderately deep to deep, well drained, and occur in a cool semi-arid climate with an average precipitation of about eight to 25 inches. Most of the Chestnut Soils in the Maggie Creek Sub-Basin occur at elevations above 5,000 feet, in the uplands.

### Grumusols Soils (Symbol: T)

These soils have a dark A horizon about 50 inches thick with no B horizon. The surface one to four inches is generally of moderate to strong granular structure. Below this, the structure may be prismatic or weak to strong blocky. Wide vertical cracks are common through the A horizon when soil is dry. Carbonate accumulation is common in the lower part of the A horizon or in the upper part of the C horizon. They are moderately fine to fine textured; are high in sticky, plastic clays; and occur in elevations below 6,000 feet in semi-arid and subhumid climates, characterized by significant wet-dry periods.

Humic Gley Soils (Symbol: H)

These are the dark brown or black meadow soils that grade into lighter colored or rust-mottled grayish soil at depths of one to two feet. They are imperfectly to poorly drained, usually with seasonal fluctuating high water table, and occur along stream floodplains where they are subject to overflow. They occur in a cool semi-arid climate, and are found in the Maggie Creek Sub-Basin at elevations mostly below 6,000 feet.

Lithosols (Symbol: L)

These soils have an incomplete profile, or no clearly expressed morphology. They are shallow (less than 10 to 15 inches), and consist of freshly and imperfectly weathered masses of hard rock or hard rock fragments, and are largely confined to steeply sloping lands. In the higher rainfall areas of the sub-basin, some of these soils may have dark A horizons. They are usually excessively drained.

Regosols (Symbol: R)

These are soils which consist of deep unconsolidated deposits, in which few or no clearly expressed soil characteristics have developed. They are largely confined to colluvial accumulations on steep mountain slopes. Under eight to 10 inches rainfall, the Regosols may have only a weakly developed A horizon, while in higher rainfall areas they may have well developed dark A horizons six to 14 inches or more thick. In mountainous areas these soils may be underlain by bedrock 15 to 20 inches below the soil surface.

Sierozems (Symbol: S)

These are soils with pale grayish or light brownish surface soils and textural B horizons closely related in color to the surface soil. They are usually calcareous in the B horizon, and frequently also in the surface soil. They quite often have a cemented calcium carbonate hardpan at shallow to moderate depths below the B horizon. The B horizon in the Sierozem Soils in this sub-basin is usually weakly developed and difficult to identify. In mountainous areas the Sierozems may be underlain by bedrock at moderate depths. These soils are found in a semi-arid cool climate, with an average annual precipitation of about seven to 13 inches, and mostly at elevations below 7,000 feet.

Solonetz (Symbol: Y)

These are imperfectly drained soils with a very few inches of light grayish or brownish surface soil underlain by a hard columnar fine-textured horizon that is high in exchangeable sodium. They occur on floodplains, terraces, and some alluvial fans, usually as small areas associated with saline-alkali Alluvial Soils, Humic Gley Soils, and Calcium Carbonate Solonchaks.

Rockland (Symbol: Z)

These are essentially non-soil areas, consisting of hard rock and hard rock fragments of granite, limestone and lava formations, which are extremely steep and inaccessible to livestock. They occur as outcrops, bluffs and cliffs with some talus areas below. Little or no weathering has taken place for soil formation. Vegetation on these areas is limited to natural fractures in the rock or small areas of deposited soil material.

## Mapping Units

Mapping units on the generalized soil survey map of the Maggie Creek Sub-Basin are associations of phases of Great Soil Groups that reflect characteristics of soils significant to use and management. Each mapping unit symbol includes the designation of approximate composition for each Great Soil Group that comprises the association.

Example: $\frac{\text{L1-C1-R1}}{\text{60-20-20}}$

## SOILS TABLES

The following tables, 8 and 9, show the general soil characteristics and the interpretations for each Great Soil Group phase which was mapped in the sub-basin.

Table 8. -- Soil characteristics, Maggie Creek Sub-Basin

| Soil Phase | Depth | Texture: Surface | Texture: Subsoil | Slope range % | Erosion | Salt & alkali | Drainage | Remarks |
|---|---|---|---|---|---|---|---|---|
| A13 | Deep | Medium to moderately fine | Medium to moderately fine | 0-2 | Slight | Moderate to strong | Imperfect to moderately well | Small areas of cropland |
| A14 | Deep | Medium | Medium | 0-2 | Slight | None to slight | Moderately well to well | Occasional overflow, 10% moderately saline and alkali |
| B1 | Moderately deep to deep | Medium | Medium to moderately fine | 30-50 | Slight 15% mod. | Slight | Well | |
| B2 | Moderately deep to deep | Medium | Medium to moderately fine | 4-15 | Slight 5% mod. | None | Well | Small areas seedable |
| B3 | Moderately deep to deep | Medium stony and very stony medium | Medium, moderately fine to fine | 4-30 | Slight 10% mod. | None | Well | 25-30% stony soils 10% deep |
| B4 | Deep | Stony medium moderately fine | Moderately fine to fine | 20-40 | Slight 10% mod. | None | Well | 5% Chestnut 5% Sierozem |
| B10 | Moderately deep | Medium stony | Fine over hardpan | 10-30 | Slight 5% mod. | None | Well | |
| B11 | Moderately deep | Medium | Fine over hardpan | 3-10 | Slight 5% mod. | None | Well | Small areas seedable |
| C1 | Moderately deep to deep | Stony medium and medium | Medium to moderately fine | 30-50 | Slight 15% mod. | None | Well | 10% very stony 10% deep Chestnut soils |
| C2 | Moderately deep to deep | Medium | Medium to moderately fine | 4-15 | Slight 10% mod. | None | Well | 15-20% stony soils |
| C4 | Deep | Medium | Moderately fine to fine | 16-50 | Slight 5% mod. | None | Well | 20% stony soils |
| H2 | Deep | Medium | Medium | 0-2 | Slight | None | Imperfect to poor | Overflowed |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| H4 | :Deep | :Medium | :Medium to mod- | : 0-2 | :Slight | :None | :Poor | :Overflowed |
| | : | : | :erately fine | : | : | : | : | : |
| L1 | :Shallow over | :Stony and rocky | : | : 50-70 | :Slight | :None | :Excessive | :10% rock outcrop |
| | :bedrock | :medium | : | : | :20% mod. | : | : | : |
| L3 | :Shallow over | :Stony and rocky | : | : 30-50 | :Slight | :None | :Excessive | :10% rock outcrop |
| | :bedrock | :medium | : | : | :15% mod. | : | : | : |
| L4 | :Shallow over | :Stony and gravelly | : | : 30-60 | :Slight | :None | :Excessive | : |
| | :bedrock | :medium | : | : | : | : | : | : |
| L10 | :Shallow over | :Stony and rocky | : | : 30-60 | :Moderate | :None | :Excessive | :10% rock outcrop |
| | :bedrock | :medium | : | : | :10% sev. | : | : | : |
| L11 | :Shallow over | :Stony and gravelly | : | : 10-30 | :Slight | :None | :Excessive | :10% rockland |
| | :bedrock | :medium | : | : | :10% mod. | : | : | : |
| L12 | :Shallow over | :Stony medium | : | : 16-30 | :Slight | :None | :Somewhat | :10% rock outcrop |
| | :bedrock | : | : | : | :5% mod. | : | :excessive | : |
| R1 | :Moderately | :Stony and gravelly | :Stony and grav- | : 30-60 | :Slight | :None | :Somewhat | : |
| | :deep to deep | :medium | :elly medium | : | :15% mod. | : | :excessive | : |
| R12 | :Moderately | :Very gravelly and | :Very gravelly | : 50-65 | :Slight | :None | :Somewhat | : |
| | :deep to deep | :stony medium | :and stony medium | : | :20% mod. | : | :excessive | : |
| S3 | :Moderately | :Stony medium | :Medium | : 15-30 | :Slight | :None | :Well | : |
| | :deep to deep | : | : | : | :15% mod. | : | : | : |
| S4 | :Moderately | :Medium | :Medium | : 2-15 | :Moderate | :None | :Well | :20% stony soils |
| | :deep to deep | : | : | : | :gullying | : | : | : |
| S10 | :Moderately | :Medium | :Moderately fine | : 10-30 | :Slight | :None | :Well | : |
| | :deep over | : | : | : | :15% mod. | : | : | : |
| | :hardpan | : | : | : | : | : | : | : |
| S11 | : Moderately | :Medium | :Moderately fine | : 3-10 | :Slight | :None | :Well | :15% saline-alkali |
| | :deep over | : | : | : | : | : | : | :Solonetz soils |
| | :hardpan | : | : | : | : | : | : | : |
| T1 | :Moderately | :Fine | :Fine | : 2-16 | :Slight | :None | :Moderately | : |
| | :deep to deep | : | : | : | :10% mod. | : | :well | : |
| Y2 | :Deep | :Medium and mod- | :Moderately fine | : 0-3 | :None | :Strong | :Moderately | :10% saline-alkali |
| | : | :erately fine | :and fine | : | : | :alkali in | :well | :soils |
| | : | : | : | : | : | :subsoil | : | : |

Source: Humboldt River Basin Field Party.

Table 9. -- Interpreted soil characteristics, Maggie Creek Sub-Basin

| Soil Phase | Precip. zone (inches) | Erosion hazard | AWHC 1/ (inches) | Soil Hydrologic Group | Capability subclass | Major land use | Dominant vegetation |
|---|---|---|---|---|---|---|---|
| A13 | 7-10 | Slight | 12 | D | IVw<br>VII s | Range | Greasewood-saltgrass |
| A14 | 7-10 | Slight | 10 | B | IIw<br>VIc | Irrigated crops and range | Big sage-grass, rabbitbrush |
| B1 | 7-12 | Moderate | 4 | C | VIIe | Range | Big sage-browse-grass |
| B2 | 7-10 | Moderate | 6 | C | VIc | Range | Big sage-grass |
| B3 | 8-12 | Moderate | 8 | C | VIc<br>VIIc | Range | Big sage-grass, low sage-grass |
| B4 | 8-12 | Slight | 8 | C | VIIs | Range | Browse-grass |
| B10 | 7-20 | Slight | 5 | D | VIIs | Range | Big sage-grass, low sage-grass |
| B11 | 8-12 | Slight | 5 | D | VIs | Range | Big sage-grass, low sage-grass |
| C1 | 8-25 | Moderate | 6 | C | VIIe | Range | Big sage-low sage, browse-aspen-grass |
| C2 | 8-12 | Moderate | 8 | C | VIc | Range | Big sage-grass |
| C4 | 8-20 | Slight | 8 | C | VIIe | Range | Low sage-browse-grass |
| H2 | 8-12 | Slight | 12 | B | IIw | Meadow hayland and pasture | Meadow grass |
| H4 | 8-10 | Slight | 10 | C<br>B | IIIw | Meadow hayland and pasture | Meadow grass |
| L1 | 8-20 | Moderate | 1.5 | D | VIIs | Range and watershed | Low sage-grass |
| L3 | 8-12 | Moderate | 1.5 | D | VIIs | Range | Low sage-grass |
| L4 | 7-10 | Slight | 1.5 | D | VIs | Range and woodland | Big sage-low sage-grass |
| L10 | 10-25 | Severe | 1.5 | D | VIIs | Range and watershed | Low sage-browse-grass |
| L11 | 8-12 | Moderate | 1.5 | D | VIIs | Range and watershed | Browse-juniper-grass |
| L12 | 8-12 | Slight | 1.5 | D | VIIs | Range and watershed | Low sage-browse-grass |

Continued

Table 9. -- Interpreted soil characteristics, Maggie Creek Sub-Basin -- Continued

| Soil Phase | Precip. zone (inches) | Erosion hazard | AWHC [1/] (inches) | Soil Hydrologic Group | Capability subclass | Major land use | Dominant vegetation |
|---|---|---|---|---|---|---|---|
| R1 | 7-10 | Moderate | 6 | C | VIIe | Range and watershed | Big sage-grass |
| R12 | 10-25 | Severe | 4 | C | VIIe | Range | Browse-aspen-grass |
| S3 | 7-12 | Moderate | 4 | C | VIIe | Range | Big sage-low sage-grass |
| S4 | 7-10 | Moderate | 6 | C | VIc<br>VIIe | Range, nonstony areas<br>seedable | Big sage-low sage-grass,<br>juniper-grass |
| S10 | 8-12 | Moderate | 7 | C | VIc | Range | Big sage-grass |
| S11 | 7-10 | Moderate | 7 | C | VIc | Range | Big sage-grass |
| T1 | 7-12 | Moderate | 6 | D | VIIs | Range | Big sage-low sage, juniper-grass |
| Y2 | 7-10 | Moderate | 12 | D | VIIs | Range | Big sage-grass |

1/ Available water holding capacity.

Source: Humboldt River Basin Field Party.

## DEFINITIONS

## HYDROLOGIC SOIL GROUPS

Watershed soil determinations are used in the preparation of hydrologic soil cover complexes, which in turn are used in estimating direct runoff. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling and without the protective effects of vegetation.

Group A - Soils having high infiltration rates even when thoroughly wetted, consisting chiefly of deep, well to excessively well drained sand or gravel. These soils have a high rate of water transmission and would result in a low runoff potential.

Group B - Soils having moderate infiltration rates when thoroughly wetted, consisting chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

Group C - Soils having slow infiltration rates when thoroughly wetted, consisting chiefly of (1) soils with a layer that impedes the downward movement of water, or (2) soils with moderately fine to fine texture and slow infiltration rate. These soils have a slow rate of water transmission.

Group D - Soils having very slow infiltration rates when thoroughly wetted, consisting chiefly of (1) clay soils with a high swelling potential; (2) soils with a high permanent water table; (3) soils with a claypan or clay layer at or near the surface; and (4) shallow soils having a very slow rate of water transmission.

## LAND USE CAPABILITY CLASSES AND SUBCLASSES

The capability classification is a practical grouping of soils. Soils and climate are considered together as they influence use, management, and production on the farm or ranch.

The classification contains two general divisions: (1) land suited for cultivation and other uses; and (2) land limited in use and generally not suited for cultivation. Each of these broad divisions has four classes which are shown by a number. The hazards and limitations in use increase as the class number increases. Class I has few hazards or limitations, or none, whereas Class VIII has a great many.

Capability classes are divided into subclasses. These show the principal kinds of conservation problems involved. The subclasses are "e" for erosion, "w" for wetness, "s" for soil, and "c" for climate.

Capability classes and subclasses, in turn, may be divided into capability units. A capability unit contains soils that are nearly alike in plant growth and in management needs.

### Land Suited for Cultivation and Other Uses

Class I — Soils in Class I have few or no limitations or hazards. They may be used safely for cultivated crops, pasture, range, woodland or wildlife.

Class II — Soils in Class II have few limitations or hazards. Simple conservation practices are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

Class III — Soils in Class III have more limitations and hazards than those in Class II. They require more difficult or complex conservation practices when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

Class IV — Soils in Class IV have greater limitations and hazards than Class III. Still more difficult or complex measures are needed when cultivated. They are suited to cultivated crops, pasture, range, woodland, or wildlife.

## Land Suited for Range and Other Uses

Class V — Soils in Class V have little or no erosion hazard but have other limitations that prevent normal tillage for cultivated crops. They are suited to pasture, woodland, range or wildlife.

Class VI — Soils in Class VI have severe limitations or hazards that make them generally unsuited for cultivation. They are suited largely to pasture, range, woodland, or wildlife.

Class VII — Soils in Class VII have very severe limitations or hazards that make them generally unsuited for cultivation. They are suited to grazing, woodland, or wildlife.

Class VIII — Soils and land forms in Class VIII have limitations and hazards that prevent their use for cultivated crops, pasture, range, or woodland. They may be used for recreation, wildlife, or water supply.

## ANNUAL WATER BALANCE STUDY - 80% FREQUENCY

Annual Water Balance, as used in these studies, is the evaluation of a portion of the hydrological cycle. The cycle starts with precipitation on the watershed, and ends with the runoff, both surface and subsurface flow, after subtracting water uses and losses.

The annual water balance was calculated for an 80 percent frequency (expected to be equaled or exceeded eight out of 10 years). This frequency was used because normally such a water supply would be the quantity needed to justify land and irrigation improvements on ranches growing high-yielding crops.

Values obtained using this procedure are approximations. Accuracy would depend on the reliability of the basic soils, vegetation, and hydrologic data used, but would probably be in the range of 60 to 90 percent.

Water yield data are not available on the upper watersheds in Maggie Creek Sub-Basin. U. S. Geological Survey streamflow records for nine years on Maggie Creek and three years on Susie Creek and some measurements taken weekly during the irrigation season by the Humboldt River Water Commissioner's office were used to estimate the 80 percent outflow to the Humboldt River.

The available information used for determining precipitation in the watershed areas consisted of storage gage records at Adobe Summit, and precipitation records for stations adjacent to the sub-basin. These data gave an indication of the annual precipitation. The precipitation used in the water balance studies was determined as the quantity needed to produce the 80 percent outflow to the Humboldt River after subtracting the water uses and losses.

A flow diagram of water yields and depletion, with quantities in acre-feet, is shown in figure 1. Table 10 is a summary of the water balance studies by elevation zones for watersheds. The difference in water yield, inches per acre, is caused by the difference in watershed characteristics. These characteristics include (1) precipitation; (2) soil development; (3) condition and species of plant cover; and (4) the physical features of the drainage.

The annual water balance inventories by watersheds were made to find answers to the following questions:

1. What is the gross water yield of the watersheds in the sub-basin? Gross water yield, for the purpose of this study, is the estimated available water, both surface and sub-surface, prior to agricultural and phreatophytic use. Generally this water yield is estimated for a stream or streams at a point above the highest diversion for the main body of irrigated land on a flood plain of a valley.

2. What is the magnitude of water use and loss by each of the major ground cover types?

3. Where are the water-yielding areas in the sub-basin and in each watershed?

4. Can vegetal manipulation be used to increase water supply for beneficial use?

The sub-basin was divided into four watersheds in order to obtain a more accurate estimate of water yield, water uses and losses. They are: (1) Upper Maggie Creek; (2) Middle Maggie Creek; (3) Lower Maggie Creek; and (4) Susie Creek.

The results of the water balance studies on Maggie Creek indicated the following:

1. The 80 percent gross water yield (surface and subsurface) from the sub-basin was estimated to be 9,900 acre-feet.

2. The estimated surface and ground water use and discharge were as follows: Irrigated crops, 2,800 acre-feet on 3,100 acres; phreatophytes, 1,800 acre-feet on 2,400 acres; and outflow to the Humboldt River, 5,300 acre-feet.

3. The Tuscarora Mountains contribute 83 percent of the gross water yield of Maggie Creek.

4. Phreatophytes of low economic value (willow, rose, and rabbitbrush) use an estimated 950 acre-feet of water annually.

The results of the water balance studies on Susie Creek watershed indicate the following:

1. The 80 percent gross water yield (surface and subsurface) from the watershed was calculated to be 2,000 acre-feet.

2. The estimated surface and ground water annual use and outflow were as follows: Irrigated crops, 200 acre-feet on 200 acres; phreatophytes, 800 acre-feet on 1,500 acres; and outflow to the Humboldt River, 1,000 acre-feet.

3. The Independence Mountains produce about one-half of the gross water yield and the Adobe Range produces the other half of the yield of Susie Creek.

4. Phreatophytes of low economic value (willow, rose, greasewood, rabbitbrush, and saltgrass) use an estimated 500 acre-feet of water annually.

Table 10. -- Summary of Water Balance Studies by elevation zones for watersheds in Maggie Creek Sub-Basin for an 80% frequency

| Elevation zone (feet) | Upper Maggie Creek | | | Middle Maggie Creek | | |
|---|---|---|---|---|---|---|
| | | Water Yield | | | Water Yield | |
| | Acres | in./ac. | acre-feet | Acres | in./ac. | acre-feet |
| 8,000-8,800 | 500 | 3.12 | 130 | 1,200 | 8.10 | 810 |
| 7,000-8,000 | 6,600 | 1.33 | 730 | 18,100 | 3.24 | 4,890 |
| 6,000-7,000 | 39,400 | .27 | 900 | 53,300 | .58 | 2,580 |
| 5,000-6,000 | 7,800 | ---- | -30 | 91,100 | ---- | -90 |
| 4,900-5,000 | ------ | ---- | ----- | ------ | ---- | ----- |
| Total | 54,300 | | 1,730 | 163,700 | | 8,190 |
| Gross Water Yield: | | | 1,730 | | | 8,190 |
| Inflow: | | | ----- | Upper Maggie Creek | | 1,060 |
| Use : Irrigated cropland | | | -470 | | | -1,790 |
| Phreatophytes | | | -200 | | | -1,200 |
| Losses: | | | ----- | | | ----- |
| Discharge: To Middle Maggie Creek | | | 1,060 | To Lower Maggie Creek | | 6,260 |

Continued

Table 10. -- Summary of Water Balance Studies by elevation zones for watersheds in Maggie Creek Sub-Basin for an 80% frequency -- Continued

| Elevation zone (feet) | Lower Maggie Creek | | | Susie Creek | | |
|---|---|---|---|---|---|---|
| | | Water Yield | | | Water Yield | |
| | Acres | in./ac. | acre-feet | Acres | in./ac. | acre-feet |
| 8,000-8,800 | ------ | ---- | ----- | 100 | 2.40 | 20 |
| 7,000-8,000 | 500 | 1.44 | 60 | 3,500 | .96 | 290 |
| 6,000-7,000 | 3,500 | .27 | 80 | 58,200 | .40 | 1,740 |
| 5,000-6,000 | 25,800 | ---- | -110 | 74,000 | .01 | 60 |
| 4,900-5,000 | 3,500 | ---- | ----- | 2,700 | ---- | -50 |
| Total | 33,300 | | 30 | 138,500 | | 2,050 |
| Gross Water Yield: | | | 30 | | | 2,050 |
| Inflow: Middle Maggie Creek | | | 6,260 | | | ----- |
| Use : Irrigated cropland | | | -550 | | | -250 |
| Phreatophytes | | | -400 | | | -800 |
| Losses: | | | ----- | | | ----- |
| Discharge: To Humboldt River | | | 5,340 | To Humboldt River | | 1,000 |

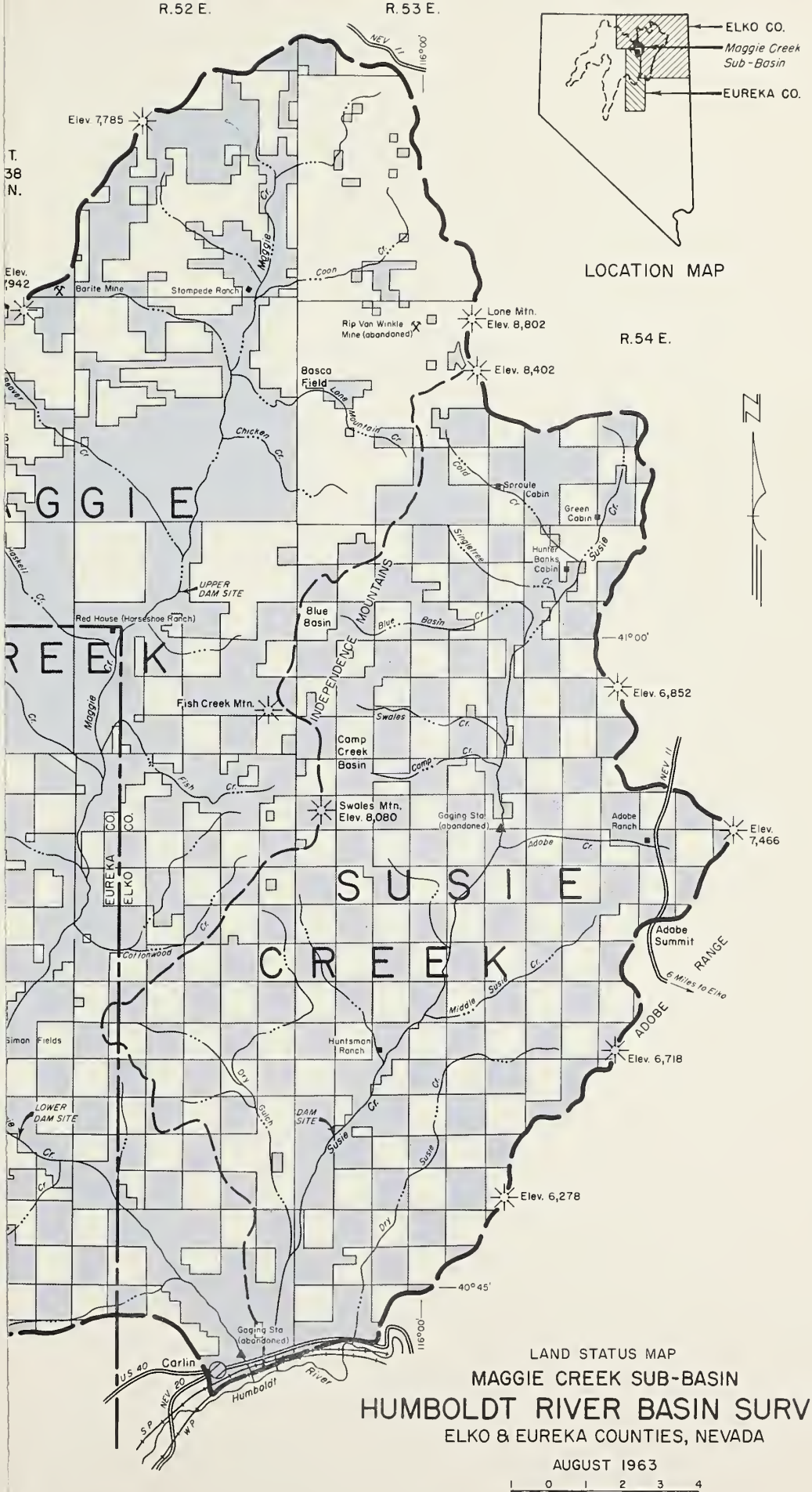
Source: Humboldt River Basin Field Party.

# APPENDIX II

This appendix is produced in a relatively limited number of copies. It contains material germane to the Maggie Creek Sub-Basin but which, because of its detailed or technical nature, is not attached to copies for general distribution.

Such material, however, has potential value as an information reservoir for technicians, administrators, and resource managers concerned with the Maggie Creek Sub-Basin.

## CONTENTS




LAND STATUS MAP

MAGGIE CREEK SUB-BASIN

# HUMBOLDT RIVER BASIN SURVEY

ELKO & EUREKA COUNTIES, NEVADA

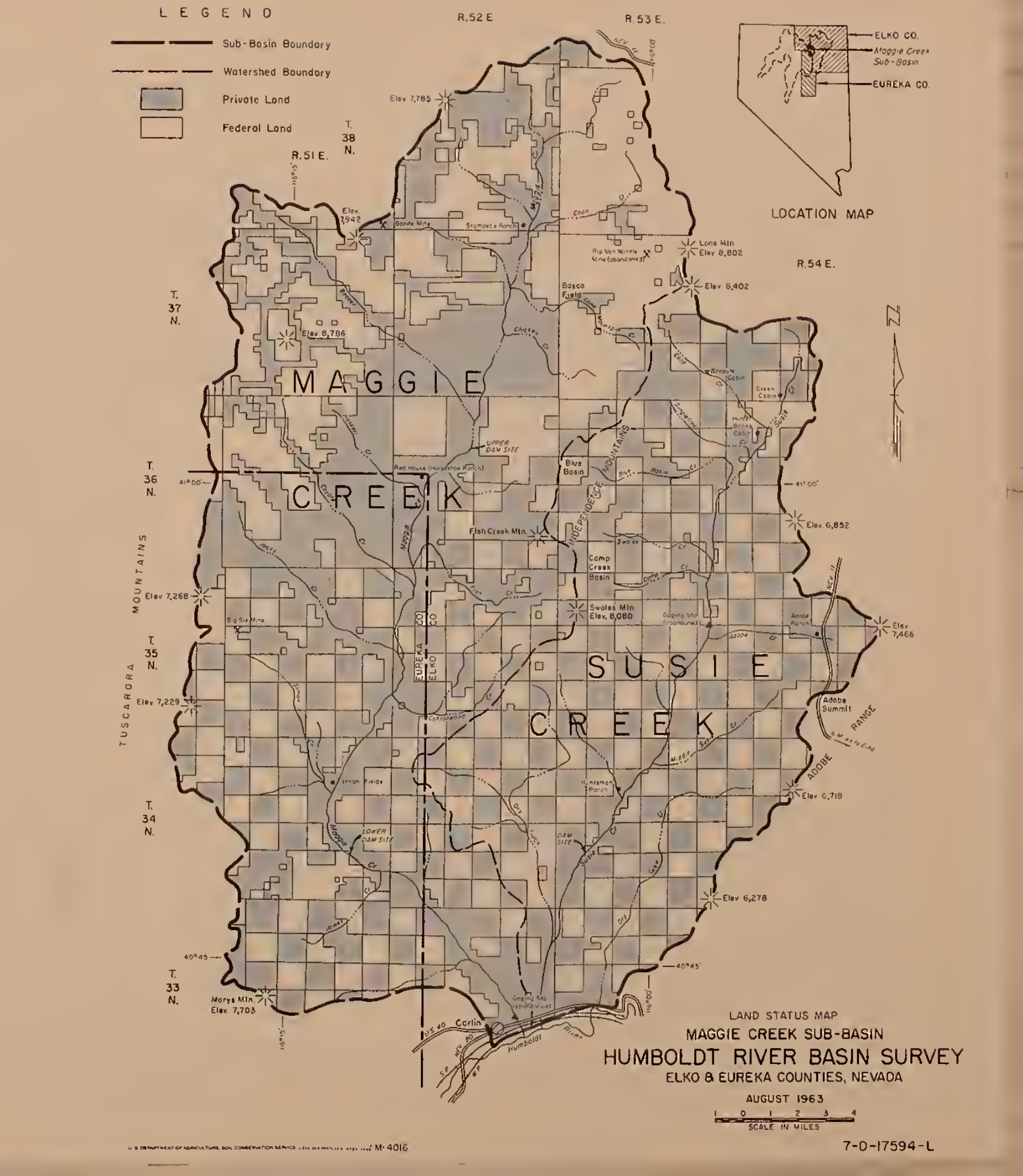
AUGUST 1963

SCALE IN MILES

0 1 2 3 4

M-4016

7-0-17594-L




LAND STATUS MAP

MAGGIE CREEK SUB-BASIN

# HUMBOLDT RIVER BASIN SURVEY

ELKO & EUREKA COUNTIES, NEVADA

AUGUST 1963

SCALE IN MILES 0 1 2 3 4

U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE ... M-4016

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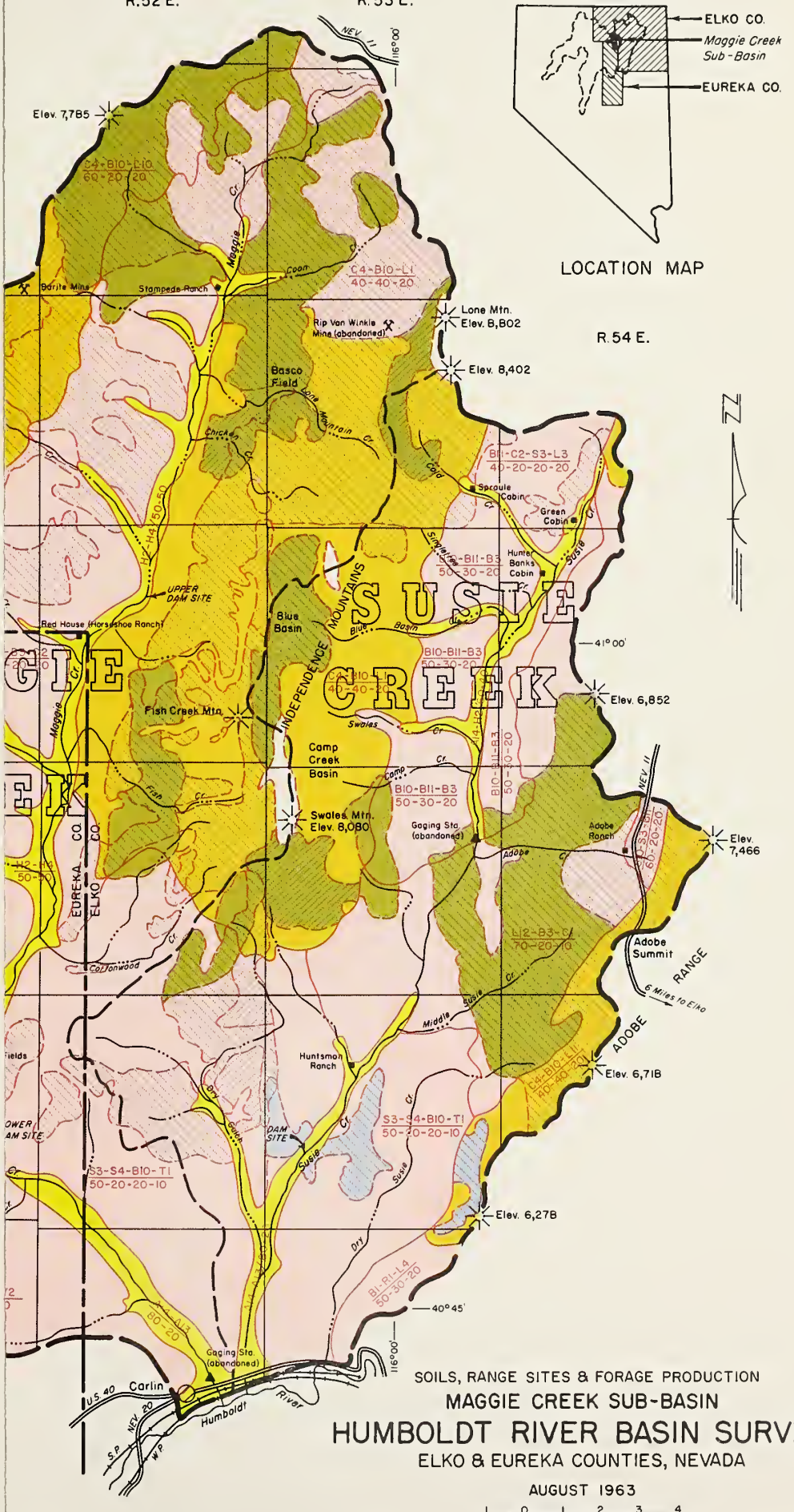



SOILS, RANGE SITES & FORAGE PRODUCTION

MAGGIE CREEK SUB-BASIN

# HUMBOLDT RIVER BASIN SURVEY

ELKO & EUREKA COUNTIES, NEVADA

AUGUST 1963

SCALE IN MILES 1 0 1 2 3 4

M-4016

7-0-17594-L

## RANGE FORAGE PRODUCTION RATES BY SITES

**RABBITBRUSH-GREASEWOOD-GRASS; SALINE BOTTOMLANDS** (Includes some irrigated acreage)

Pounds dry forage per acre
- 650-1,500
- 200-900
- 20-300

**BIG SAGEBRUSH-GRASS; UPLAND BENCHES AND TERRACES** (Includes some irrigated acreage)

Pounds dry forage per acre
- 250-600
- 100-450
- 20-150

**LOW SAGEBRUSH-GRASS; CLAYPAN BENCH**

Pounds dry forage per acre
- 200-500
- 100-250
- 50-150

**BROWSE-ASPEN-GRASS; INTERMEDIATE MOUNTAIN SLOPES**

Pounds dry forage per acre
- 300-650
- 150-350
- 50-200

**PINYON-JUNIPER-GRASS; SHALLOW STONY SLOPES**

Pounds dry forage per acre
- 100-250
- 50-150
- 10-75

BARREN OR INACCESSIBLE

B12-B3-C1 / 70-20-10 — Association of Great Soil Groups by Phases; Percent of each Great Soil Group Phase

## LEGEND

- Sub-Basin Boundary
- Watershed Boundary
- Great Soil Group Association Boundary

R.52 E. R.53 E. R.54 E. R.51 E.

T. 38 N. T. 37 N. T. 36 N. T. 35 N. T. 34 N. T. 33 N.

TUSCARORA MOUNTAINS

Elev. 7,785 Elev. 7,942 Elev. 8,796 Lone Mtn. Elev. 8,802 Elev. 8,402 Elev. 6,852 Elev. 7,466 Adobe Summit Elev. 6,718 Elev. 6,278 Elev. 7,268 Elev. 7,229 Maryo Mtn. Elev. 7,703 Fish Creek Mtn. Swales Mtn. Elev. 8,050

MAGGIE CREEK SUB-BASIN

ELKO CO. EUREKA CO.

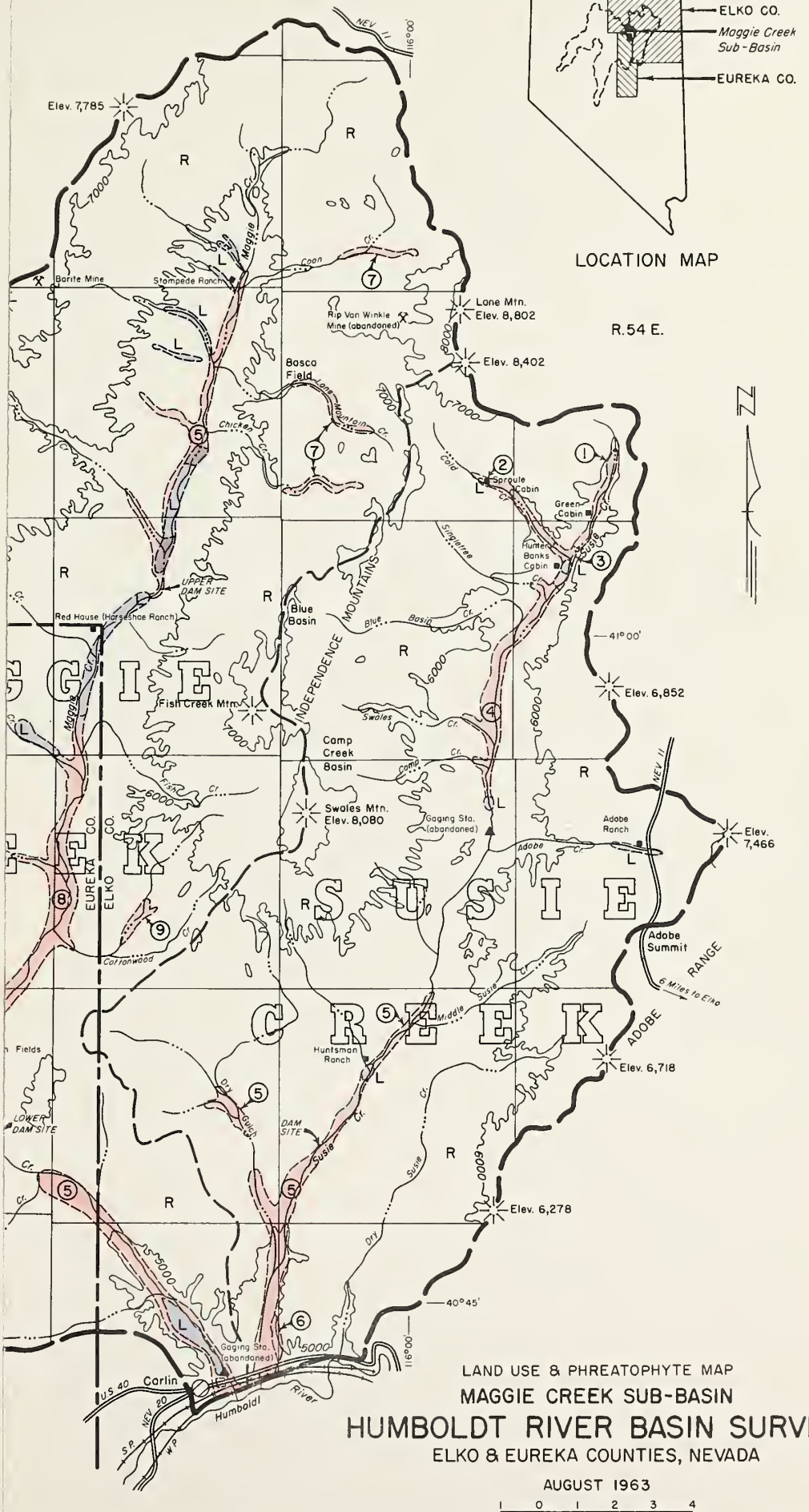
LOCATION MAP

SOILS, RANGE SITES & FORAGE PRODUCTION
MAGGIE CREEK SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
ELKO & EUREKA COUNTIES, NEVADA
AUGUST 1963

SCALE IN MILES 0 1 2 3 4

M-4016

7-0-17594-L




LAND USE & PHREATOPHYTE MAP

MAGGIE CREEK SUB-BASIN

# HUMBOLDT RIVER BASIN SURVEY

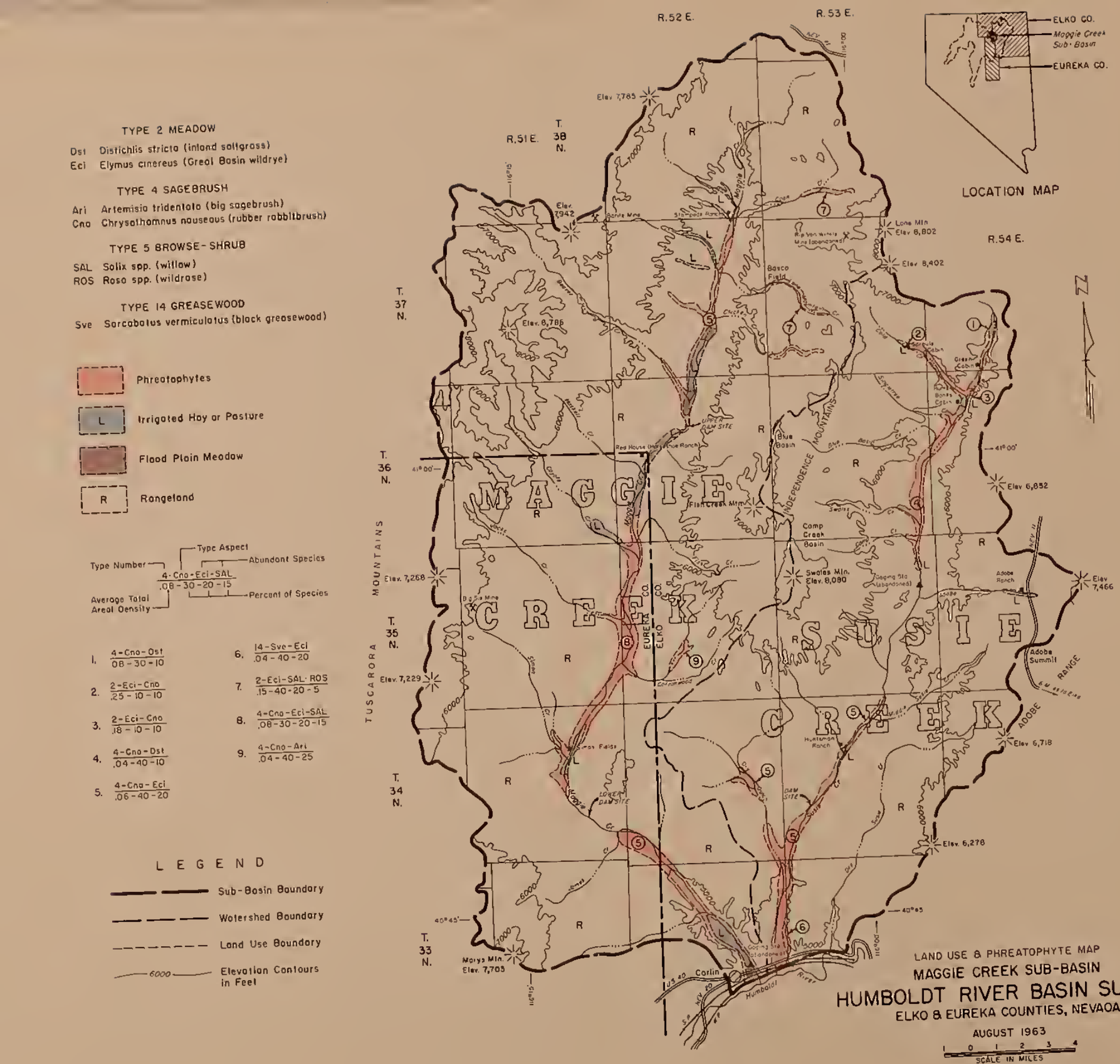
ELKO & EUREKA COUNTIES, NEVADA

AUGUST 1963

SCALE IN MILES

M-4016

7-0-17594-L


TYPE 2 MEADOW
Dst Distichlis stricta (inland saltgrass)
Eci Elymus cinereus (Great Basin wildrye)
TYPE 4 SAGEBRUSH
Ari Artemisia tridentata (big sagebrush)
Cno Chrysothamnus nauseous (rubber rabbitbrush)
TYPE 5 BROWSE-SHRUB
SAL Salix spp. (willow)
ROS Rosa spp. (wildrose)
TYPE 14 GREASEWOOD
Sve Sarcobatus vermiculatus (black greasewood)
Phreatophytes
L Irrigated Hay or Pasture
Flood Plain Meadow
R Rangeland
Type Number
Type Aspect
Abundant Species
4-Cno-Eci-SAL
.08-30-20-15
Average Total Areal Density
Percent of Species
1. 4-Cno-Ost / 08-30-10
2. 2-Eci-Cno / 25-10-10
3. 2-Eci-Cno / 18-10-10
4. 4-Cno-Dst / 04-40-10
5. 4-Cno-Eci / 06-40-20
6. 14-Sve-Eci / 04-40-20
7. 2-Eci-SAL-ROS / 15-40-20-5
8. 4-Cno-Eci-SAL / 08-30-20-15
9. 4-Cno-Ari / 04-40-25
LEGEND
Sub-Basin Boundary
Watershed Boundary
Land Use Boundary
6000 Elevation Contours in Feet
LOCATION MAP
ELKO CO.
Maggie Creek Sub-Basin
EUREKA CO.
R.52 E.
R.53 E.
R.51 E.
R.54 E.
T. 38 N.
T. 37 N.
T. 36 N.
T. 35 N.
T. 34 N.
T. 33 N.
MAGGIE CREEK
CRESCENT VALLEY
TUSCARORA MOUNTAINS
INDEPENDENCE MOUNTAINS
ADOBE SUMMIT RANGE
Elev. 7,785
Elev. 7942
Lone Mtn Elev. 8,802
Elev. 8,402
Elev. 8,786
Elev. 6,852
Elev. 7,268
Swales Mtn. Elev. 8,090
Elev. 7,466
Elev. 7,229
Elev. 6,718
Elev. 6,278
Marys Mtn. Elev. 7,705
Corlin
LAND USE & PHREATOPHYTE MAP
MAGGIE CREEK SUB-BASIN
HUMBOLDT RIVER BASIN SURVEY
ELKO & EUREKA COUNTIES, NEVADA
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